

# 47 KONVENSI CONVENTION

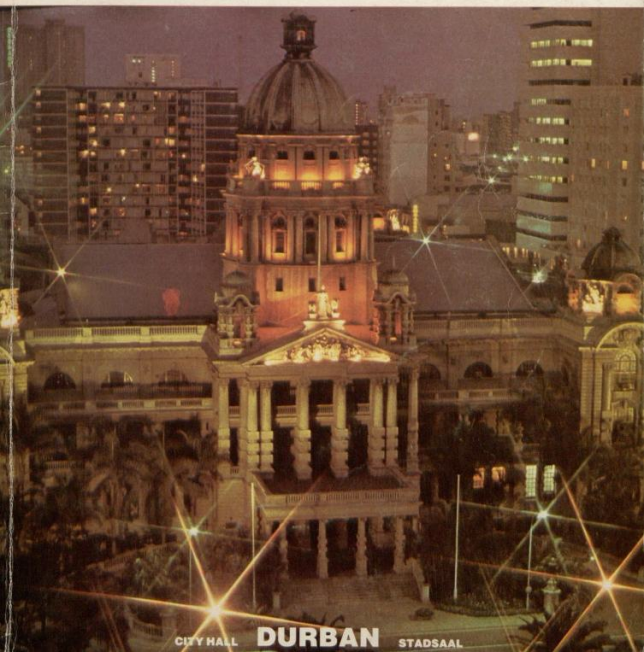


THE ASSOCIATION OF MUNICIPAL ELECTRICITY UNDERTAKINGS OF  
SOUTH AFRICA

DIE VERENIGING VAN MUNISIPALE ELEKTRISITEITSONDERNEMINGS  
VAN SUID-AFRIKA

4-6 May 1981

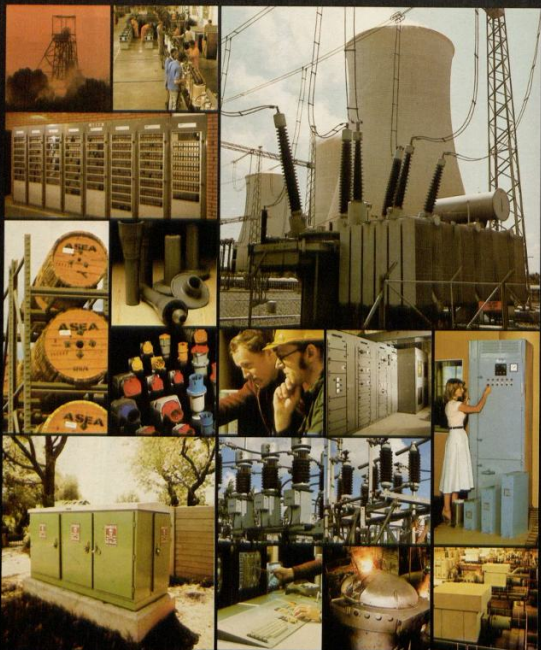
4-6 Mei 1981



CITY HALL

**DURBAN**

STADSAAL



From modest beginnings in 1946 we have grown rapidly to become a major local industry in the realm of power transformation and transmission equipment. The power transformer factory is the largest and most modern of its kind in Africa and has produced units of up to 800 MVA. Other similarly large manufacturing facilities at Pretoria West produce switchgear and allied products. At Rosslyn we have a very modern cable manufacturing plant and a new distribution transformer and capacitor factory.

Backed by such large manufacturing resources and diverse facilities we are able to offer a complete turn-key supply and installation package for either static power transformation and distribution for either static power transformation or rotating drives up to and including large mine hoists. We are a South African company, ably backed by a wealth of technical expertise through our association with the international Asea group, and this has enabled us to remain in the forefront of electrical engineering in South Africa.

# ASEA

**Asea Electric South Africa Limited**

P.O. Box 691, Pretoria, 0001, Telephone (012) 79 7020, Telex 3-725 SA

# PHOSWARE LIGHTING



By courtesy of Johannesburg Municipality

**Phosware**  
(PTY) LTD.

JANSEN ROAD, NUFFIELD,  
SPRINGS, TRANSSVAAL  
TELEPHONE 818-5811/2.  
P.O. BOX 391, 1560 SPRINGS



# CU AL ENGINEERING

(PTY) LTD

ELECTRICAL AND MECHANICAL ENGINEERS SUPPLIES

2 ENFIELD ROAD  
DURBAN  
4001  
TEL. ADD. "CUALCABLE" DURBAN

TELEPHONE:  
NATIONAL (031) 210285  
INTERNATIONAL 27 31 210285

P.O. BOX 18228  
DALBRIDGE  
4014  
TELEX 6-2916 SA



Aluminium and Copper Conductors ■ PVC Insulated Housewiring and Overhead Service Cable ■ Paper and PVC Insulated Telephone Cable ■ Paper, PVC and XLPE Insulated Power Cable ■ Welding Cable.



Disc ■ Line Post ■ Pin ■ Shackle ■ Reel Bus Bar ■ Stay Insulators  
Ironwork for Overhead Power Lines ■ Stay Rods ■ Stay Wire ■ Poles ■ Galvanised Bolts ■ Washers ■ Nuts ■ Coach Screws Tools for the Erection of Overhead Power Lines

*Preformed*

LINE PRODUCTS

Parallel Groove Clamps for AL/AL and AL/CU Connections □ Preformed Insulator Ties Guy Grips ■ Pole Top Make Offs ■ Line Guards ■ Armour Rods ■ Dead Ends ■ Vibration Dampers ■ Splices.



Cable Joint and Terminal Boxes ■ Joint Box Compound ■ Solder ■ Wiping Metal ■ Jointers Furnaces ■ Compound Buckets ■ Tallow Flux ■ Lead Pots ■ Beaters ■ Ladles.

ITT BLACKBURN

Copper Coated Steel Earth Rods ■ Couplings and Clamps ■ Copper and Aluminium Earthing Tape and Braid ■ Lightning Protection.

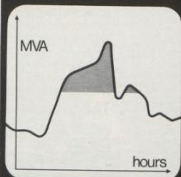
Raychem

Heat Shrink Cable Terminations and Joints for all Voltages ■ Heat Shrink Tube ■ End Caps and Boots.

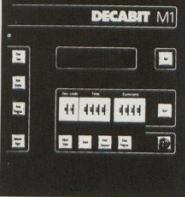
SUGAR AND EXPORT DIVISION

Fletcher & Stewart Mills ■ Rotary Louvre and Cascade Dryers ■ Eimco Filters and Extractors ■ Cattle Feed Plants ■ Demisters/Mesh Separators

# The Problem



# The Solution



## Optimum load management with Zellweger DECABIT®

The problem to ensure a continuous and economical electricity supply requires specific efforts in load management to improve load factors and reduce costs without inconveniencing end users.

Effective load management calls for modern, flexible control systems to switch selected loads on and off subject to various network parameters. The resulting cost benefits can be very substantial.

The solution for the safe and fast execution of load management in today's power networks is DECABIT. Zellweger's modern DECABIT system provides fast and reliable transmission of a large number of switching commands through existing power networks for load management and other functions.

A continuous research and development program ensures progress while strong local presence guarantees availability and service.

012 112E

Zellweger Uster Ltd.  
CH-8610 Uster  
Switzerland  
Telephone 01/940 67 11  
Telex 53587



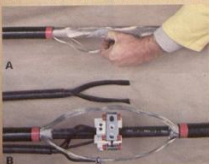
Representative:

Farad Pty. Ltd.  
5 Zambesi Road, EMMARENTIA 2195  
Johannesburg/South Africa  
Telephone 41-4446  
Telex 4-24405

# Without us, Miriam Kabako would be an illiterate, hungry, cold little girl.

Miriam Kabako has never known a life without electricity. Her grandparents did. In their lifetime the economic miracle that is electrification has transformed the pattern of living for millions. In schools, township streets, shops, community centres, hospitals, and places of entertainment; on the railways, in high rise buildings, down the deepest mines, electricity has played its vital role, bringing steadily improving living standards to families like the Kabakos. And electricity, silent servant of a nation, is brought to the nation through the many products of African Cables. A South African company. Suppliers to South Africa for more than 40 years.

## The market leader in action



*Cheaper to install, easier to connect to, this 'Waveform' CNE cable is manufactured by African Cables especially for township power reticulation. The design allows "hot" connections, and so eliminates the need for power shutdowns during extension work.*

*'A' Drawing aside the uncut waveform neutral/earth conductor*

*'B' One 3-phase 'Tee-off' is connected, with a second ready for connection. Note that the waveform neutral/earth is still uncut and remains so, throughout the operation.*

**african  
cables**

South Africa's Lifelines



Our distributors are:

Delta Enfield Cables (SA) (Pty) Ltd. 683-8300

GEC Cables 826-6647

Johnson & Phillips Cables (SA) (Pty) Ltd. 836-9036



Electricity, water, sewerage, traffic.  
Without these a city stops dead.

Every second of the year the services that citizens take for granted have to be provided, monitored and controlled.

- Electricity – switchgear from 3,3 kV to 132 kV are manufactured in South Africa to local and international standards. Small oil volume and SF6 technologies cover the field of applications. High voltage CT, VT and CVT also supplied for network protection.

- Designed and manufactured in South Africa, the Fulcontrol 6000 range of Telemetry and Telecontrol equipment provides remote control and data acquisition in a wide variety

of applications.

All models provide maximised information transfer, automated maintenance routines, high reliability, compact packaging and the very latest microprocessor technology.

Call us for information today and find out just how Fulmen Africa can keep your city moving.



**Fulmen**

# A CITY NEVER SLEEPS.



Lovely  
**sangamo**  
the best looking  
meter made.

**30 years of faithful  
service without maintenance.**

- Extremely accurate
- Wide load range
- Maintenance free "Floton" bearing
- Stable in all climatic conditions

Call us if you're after an outstanding meter.  
We'll gladly send you a detailed  
breakdown on our lovely Sangamo.



**Hubert Davies**   
ELECTRICAL ENGINEERING

A Hubert Davies Engineering Supply Company

Johannesburg: P.O. Box 1386, Johannesburg 2000. Tel. 36-2511. Telex 8-0593  
Cape Town: P.O. Box 333, Bellville 7530. Tel. 95-2171. Telex 57-7223  
Durban: P.O. Box 1173, Pinetown 3600. Tel. 72-2301. Telex 6-5029  
Port Elizabeth: P.O. Box 2004, North End 6056. Tel. 42-2061. Telex 74-7011  
or through any Hubert Davies Engineering Supply Company branch countrywide.



# FERRANTI.



# THE METER MAKERS.

Ferranti Measurements Limited of Hollinwood, United Kingdom manufacture a wide range of single and polyphase meters, together with summation metering equipment, specifically developed for your particular requirements.

The range includes:

Single Phase kWh meters manufactured, calibrated and tested in Sulzer's Johannesburg meter assembly operation;  
Polyphase 3 and 4 wire kWh meters of various types;  
Precision and Maximum Demand Polyphase meters;  
Maximum Demand Alarm meters; Pulsava Electronic kVA meters.

Ferranti products are marketed in South Africa by Sulzer Brothers. Proof that only the best back the best.



## FERRANTI

SULZER BROTHERS (SOUTH AFRICA) LTD - ELECTRICAL DEPARTMENT

9th Floor, Access City, Beacon Road, Doornfontein 2094. P.O. Box 930, Johannesburg 2000. Tel. (011) 37-4170/1/2  
Cape Town. P.O. Box 6913, Roggebaai 8012. Tel. (021) 21-5650. Durban: P.O. Box 1877, Durban 4000. Tel. (031) 33-5543.



## The Greatest Name in Plastics

AECI is in the forefront of the plastics materials industry, backed up by the high level of research, development and technical service the country has come to expect from us.

These brand names pioneered the plastics industry in South Africa:

- 'Alkathene' : Low density polyethylene
- 'Welvic' : PVC compound
- 'Corvic' : PVC polymer
- 'Perspex' : Acrylic sheet

Watch out for our new LLDPE — linear low density polyethylene — it may just start a minor revolution in the plastics world!



Plastics Division Carlton Centre P.O. Box 1122 Johannesburg 2000

**MAY 1981 MEI**  
**CONTENTS — INHOUD**

OFFICIAL OPENING — AMPTELIKE OPENING OPENING ADDRESS — OPENINGSREDE. Sy Ed. F. W. de Klerk, Minister van Mineraal en Energie- sake .....	11	Ad hoc Committee to investigate legislation and practice for electrical wiring work in S.A. — Ad hoc- komitee om ondersoek in te stel na wetgewing en ge- bruik vir elektriese bedragswerk in S.A. ....	135
INDUCTION OF PRESIDENT — INHULDIGING VAN PRESIDENT .....	14	S.A. Electrolytic Corrosion Committee — S.A. Komitee vir Elektrolytiese Ververing .....	149
ELECTION OF PRESIDENT ELECT — VERKIE- SING VAN AANGEWESSE PRESIDENT .....	17	AMEU/ECA Liaison Committee — VME0/EKV- skakelkomitee .....	155
GREETINGS — GROETE .....	18	High Voltage Co-ordinating Committee — Ko-ordine- rende Hoogspanningskomitee .....	156
PRESIDENTIAL ADDRESS—PRESIDENTSREDE D. H. Fraser .....	19	World Energy Conference — Wêreld-energiekonfe- rensie .....	156
CONFERMENT OF HONORARY MEMBERSHIP — TOEKENNING VAN ERE-LIDMAATSKAP .....	21	CSIR/NEERI Advisory Committee — WNNR/ NEERI-Advieskomitee .....	157
ACCEPTANCE OF NEW CONSTITUTION — AANVAARDING VAN NUWE GRONDWET .....	32	CSIR Solar Energy Steering Committee — WNNR- sonenergie-loodskomitee .....	161
ELECTION OF EXECUTIVE COUNCIL — VER- KIESING VAN UITVOERENDE RAAD .....	35	NBRI Working Subcommittee on rational norms for Electricity Distribution Networks — NBNI-Werke- subkomitee vir rasionele norme vir elektriese ver- spreiding netwerke .....	166
PAPERS — REFERATE: "Capital Finance of Electricity Undertakings", by O. D. Gorven .....	35	NBRI Steering Committee on rational norms for Township Services — NBNI-Loodskomitee vir rasio- nele norme vir Stedelike Dienste .....	166
"Streetlighting — Lets be practical", by R. S. Yates "An Introduction to Engineering Economics", by D. C. Palsler .....	38	CSIR/NBRI Advisory Committee — WNNR/NBNI- Advieskomitee .....	168
"The Training of Asians for the Engineering Indus- try", by Dr. A. Solomon .....	50	SANCI — SANKV .....	170
REPORTS — VERSLAE: Secretarial — Sekretarieel .....	64	SANCI/ILESA/AMEU Streetlighting Advisory Committee — SANKV/IVISA/VME0 Straatlig Advie- skomitee .....	171
Financial — Finansiël .....	98	44th AGM IEC: Sydney — 44e Jaarvergadering IEK Sydney .....	176
Recommendations Committee for new electrical com- modities — Aanbevelingskomitee vir nuwe elektriese ware .....	108	45th AGM IEC: Stockholm — 45e Jaarvergadering IEK Stockholm .....	179
ESCOM Committee — EVKOM Komitee .....	114	CIE 19th Session — 19e Sessie, CIE .....	172
SABS Co-ordination Committee — Ko-ordinerende SABS-komitee .....	115	TC 64 Session — TK 64 Sessie, Pretoria .....	175
Technical Training Committee — Komitee vir Tegniese Opleiding .....	117	The Chief Inspector of Factories, A. A. Weich — Die Hoofinspekteur van Fabriek, A. A. Weich .....	156
Electrical Wiresmen's Registration Act — Registra- sieraad vir Elektrotegniese Draadwerkers .....	120	CLOSING SESSION — AFSLUITINGSESSIE .....	186
Code of Practice for Earthing Committee — Aar- dingsgebruikskodekomitee .....	131	MEMBERSHIP ROLL — LEDELYS .....	194
	135	ADVERTISERS — ADVERTENSIE .....	201

**PUBLISHERS AND PROPRIETORS**  
**UITGEWERS EN EIENAARS**

The Association of Municipal Electricity Undertakings of  
South Africa.  
Die Vereniging van Munisipale Elektriesitsondernemings  
van Suid-Afrika.

**GENERAL EDITOR AND ADVERTISING MANAGER**  
**ALGEMENE REDAKTEUR**  
**EN ADVERTENSIEBESTUURDER**

Bennie van der Walt  
Tel.: 838-7711  
JOHANNESBURG

**OFFICES**  
**KANTORE**

Volkskas Building 613 Volkskasgebou  
Market Street 76 Markstraat  
JOHANNESBURG  
Tel.: 838-7711  
2001

**BRANCH CHAIRMEN**  
**VOORSITTERS VAN TAKKE**

G. R. Beard — Cape Eastern/Oos-Kaap  
J. G. Hugo — Good Hope/Goeie Hoop  
E. G. Davies — Natal  
G. J. Nortje — Highveld/Hoëveld  
N. S. Botha — Vrystaat/Noord-Kaap

**EXECUTIVE COUNCIL UITVOERENDE RAAD**

D. H. Fraser — President (Durban)  
W. Barnard — President Elect (Jhb.)  
Aangewese President  
F. J. Botes — Roodepoort  
J. A. Loubser — Benoni  
Clr. S. A. Lange — Durban  
Rld. C. Venter — Johannesburg

**MEMBERS — LEDE**

N. S. Botha — Bloemfontein  
E. G. Davies — Pietermaritzburg  
J. D. Dawson — Uitenhage  
E. de C. Pretorius — Potchefstroom  
A. H. L. Fortmann — Boksburg  
K. J. Murphy — Somerset West  
D. C. Palsler — Cape Town  
D. E. T. Potgieter — Verwoerdburg  
K. G. Robson — East London  
G. C. Theron — Vanderbijlpark  
J. K. von Ahlfen — Springs  
Rld. Prof. P. J. Botha — Potchefstroom  
Clr. R. E. Reusel — East London  
Clr. H. J. Hugo — Roodepoort  
Clr. F. v. d. Velde — Cape Town  
Rld. J. L. Steyn — Boksburg  
Rld. C. J. Fourie — Uitenhage  
Rld. D. E. Biddulph — Verwoerdburg  
Rld. D. de Roos — Springs  
Rld. D. Taljaard — Benoni  
Rld. Prof. J. S. v. d. Walt — Bloemfontein  
Rld. C. Borchardt — Vanderbijlpark

# Lighting the Brixton Tower without Thorn C.S.I. Floodlights is like planning a building without foundations.

An unusual lighting problem frequently calls for an innovative solution.

That's why SABC used Thorn C.S.I. to make the Brixton Tower a shining landmark in the dark.

Thorn's experience in outdoor lighting goes back 50 years and today covers 164

M.B.L. Floodlights - uses linear metal halide lamp to produce colour TV lighting for stadium or area flood-lighting for industry and security lighting.



countries and seven continents. Internationally, Thorn spends millions on specialised research. Pioneering most of the



C.S.I. Floodlight - high intensity symmetrical projector with compact louvre lamp designed to produce colour TV lighting for sports stadia.



light sources you see today, and many you'll be seeing tomorrow. It is this unparalleled experience that allows Thorn to provide the most sophisticated and technically perfect answer to any lighting challenge.

And it's one of the reasons why Thorn is a major lighting supplier to so many top South African organisations today.

Your specific lighting needs may not be those of the SABC.

That's why you need to look at the International expertise and knowledge that Thorn will offer you.



Tungsten Halogen - general purpose, low cost floodlight using a variety of wattages - can use linear high pressure sodium lamp.

## THORN. Improves the quality of light.

**PROCEEDINGS  
47TH CONVENTION  
4TH TO 6TH MAY 1981  
ELANGANI HOTEL  
DURBAN**



**VERRIGTINGE  
47E KONVENSIE  
4 TOT 6 MEI 1981  
ELANGANI HOTEL  
DURBAN**

Rev. Jock Ellis opened the proceedings with scripture reading and prayer.  
Da. Jock Ellis het die verrigtinge met skriflesing en gebed geopen.

**TABLE OF ATTENDANCE/TABEL VAN BYWONING**

Honorary Members	8	Erelede
Guests	40	Gaste
Engineers	89	Ingenieurs
Associates	17	Geassosieerdes
Local Authorities	65	Plaaslike Besture
Affiliates	190	Geaffilieerdes
Ladies	220	Dames
Staff	25	Personeel
		654

Apologies 15

**OFFICIAL OPENING  
AMPTELIKE OPENING**

**MNR. P. J. BOTES: PRESIDENT**

Verwelkoming/Welcme

Sy Edele Minister De Klerk, her Worship Madam Mayor Mrs. Hotz, gaste, dames en here — dit is vir my aangenaam om u almal hartlik welkom te heet by die 47ste Konvensie van die Vereniging van Munisipale Elektriesiteitsondernemings van Suid-Afrika in die 66ste jaar van sy bestaan. In die besonder wil ons die geagte Minister van Mieraal en Energie Sake, mnr. F. W. de Klerk hier welkom heet, wat te midde van al sy werksaamhede nog die tyd kon afknyp om ons te vereer met sy teenwoordigheid en om die openingsrede te lewer. Na so 'n algemene verkiesing is dit miskien ook so 'n asemsepkansie.

It is with regret that I have to announce the deaths during the past year of Messrs. D. Murray-Nobbs, D. A. Bradley and J. E. Mitchell and I would ask you to stand for a moment as a mark of respect.

Ook wil ons vanoggend welkom heet verteenwoordigers van die volgende instansies:—

Die Instituut van Stadsklerke van S.A. wat deur mnr. Haygarth verteenwoordig word.

EVKOM — verteenwoordig deur mnr. Jan Smith, Voor-sitter en mnr. Stofberg en Wohlberg.

Ciskei Government — Mr. Jan Piva.

Lesotho Electricity Corporation — Mr. Colin Dunn.

Department of Man Power Utilization — Messrs. Weich and Roskin.

Department van Pos- en Telekommunikasiewese.

Departement van Gemeenskapontwikkeling en Owerheidsdienste.

The National Building Research Institute and NEERI of the CSIR.

The S.A. Bureau of Standards.

S.A. Railways and Harbours.

University of Natal.

Ook het ons verteenwoordigers van die Pers hier vandag.

In die besonder wil ek graag mnr. Uys, Raadslid van Stellenbosch ook hier welkom heet, een van my leermeesters aan wie ek baie dank verskuldig is.

Here ons waardeer u teenwoordigheid hier vandag en vertrou dat u teenwoordigheid die basis sal vorm vir nog beter koördinasie en samewerking.

We also wish to welcome the representatives from Zimbabwe — your presence is appreciated.

It is with great pleasure that I now ask all the Past Presidents and Honorary Members of this Association present this morning to stand up so that we can greet you and see who you all are.

Thank you.

May I ask Mr. Ronnie Simpson, Past President and Honorary Member to stand up again please. Sir, almost exactly 21 years ago on 3 May 1960, you were inducted President of this Association. You were the last City Electrical Engineer from Durban to hold this office and it is remarkable that, after all these years, Mr. Fraser, your immediate successor, now becomes President. We trust that the proceedings today will bring back pleasant memories to yourself and to your good lady. Thank you.

We are naturally pleased to have with us Mr. Fraser, President Elect, this morning. I may now tell you that Mr. Fraser was very ill only a few days ago and we are pleased to see him so fit and healthy today.

May we at this stage also congratulate Mr. Fraser and his staff on this beautifully decorated hall and all the amenities provided.

May I now call on Her Worship the Mayor of Durban, Clr. Mrs. S. C. Hotz to welcome you to the Convention.

**WELCOMING ADDRESS BY HER WORSHIP  
THE MAYOR CLR. MRS. SCHOTZ**

Mr. President, the Honourable Minister, Ladies and Gentlemen, it is for me a pleasure to welcome you to Durban to the 47th Convention of the Association of Municipal Electricity Undertakings of South Africa.

Hierdie Konvensie is vir Durban 'n heuglike gebeurtenis aangesien ons Stadsselektrogetegniese Ingenieur, mnr. Denis Fraser, vandag as President van hierdie Vereniging ingehuldig word. During the 66 years since the AMEU was founded, Durban has had 6 city electrical engineers who have all achieved this honour but I, as mayor, would like to say that my welcome to you all cannot help being that much more warm as we are to see the head of one of our most important departments being invested as president as his four predecessors have been.



Mrs. S. C. Hotz.

Meneer die Minister, baie dankie dat u na Durban gekom het om hierdie Konvensie te open. Ons stel dit hoog op prys.

I would also like to welcome all the ladies who have accompanied their menfolk, it looks to me as if there are more ladies at this convention than at any other I have been to during my term of office — I can only assume that you are all here to ensure that the delegates don't "Light up the Town". Amongst the information that was sent to me by Mr. Fraser, were three welcoming speeches of past mayors of our city at previous conventions held in Durban.

I felt as though I were reading in the true archives of events and not just of 21 years ago and I am lost in admiration of the growth, not only of our city, but the growth around us, which is directly related to the expansion of our electricity's undertakings.

In 1960 the then mayor bragged about the 4 000 houses that were being constructed and the 20 000 houses that were being planned to alleviate the chronic shortage of housing for the Indian population in our city. He expressed reservations as to whether electricity supplies should be provided for these homes. Fortunately his suggestion at the time that gas be installed did not find favour with our city electrical engineer. The building of these homes is now history and we are at present involved with Phoenix, which will provide 32 000 units ultimately housing 220 000 people.

The electrical reticulation in this city within a city has placed an enormous load on our electricity department — a department plagued by shortages of skilled staff. Yet, in spite of the acute shortages of staff and the continued expansion of our undertaking, we can, as a city, be justly proud of our electricity department.

Electricity service has been hampered by lack of qualified staff. Steps have been taken to improve the grading structure for artisan staff and there have been extensive training programmes to qualify non-White staff for this essential service.

It has always been my belief that the service that they provide is undervalued and taken so much for granted by all who expect power at the turn of a switch without giving any thought to the magnitude of work load on those responsible for providing this modern luxury to thousands of people. As Durban is one of the major growth points in the country, more and more demands will be made on our electricity department and I believe one of the most important expansions of all should be reticulation for supplying the homes of the people in our surrounding townships, we are all aware of what is being done in this aspect in Soweto and I sincerely hope that the day is not too far away when government financing will enable us to provide a facility which could change dramatically the lives of thousands of people today. The population of the city is almost one million. Sales of electricity have increased by 40 785 times since the commissioning of the Point power station in 1897 and doubled in the last 10 years. The sale of electrical energy is expected to reach R150-m this financial year. In the 1979-1980 financial year our energy sales became bigger than those of any other municipality in the Republic and, for the first time, exceeded those of Johannesburg.

We have over 185 000 consumers — more than any other municipality in the Republic.

I can go on in this vein, Mr. President, telling you just how great Durban's electricity department is, but what I am really saying to you all is that electricity in this modern age is an indispensable tool without which no industrialised nation could survive.

Meneer die President, ek is daarvan seker dat hierdie Konvensie baie gelaagd sal wees.

I look forward to the times I shall be spending with you and, once again, on behalf of my City I welcome you all.

**MR. P. J. BOTES: PRESIDENT**

Your Worship of course for us there can be only one Durban. I can assure you we will enjoy our stay here. Thank you very much for welcoming us to this beautiful city of yours. The ladies especially are looking forward to what you here in Durban have in store for them. Of course the men have to work for their existence. Kindly convey to your Council our appreciation of their invitation to us to hold the Convention in Durban.

## OPENING ADDRESS OPENINGSREDE

Dames en here, ons is besonder bevoorreg om die Minister van Minerale en Energiesake, sy Edele mnr. F. W. de Klerk by ons te hê om die 47ste Konvensie van die VMEO te open.

Frederik Willem de Klerk is op 18 Maart 1936 gebore. Hy behaal die graad B.A. LL.B. met lof in 1958 aan die Universiteit van Potchefstroom vir CHO.

Gedurende sy universiteitsloopbaan presteer hy nie net op akademiese gebied nie maar neem ook 'n leidende aandeel in studente-aangeleenthede en was onder meer Ondervoorsitter van die Studenteraad, Hoofbestuurslid van die ASB en die wenner van die Abe Bailey Reisaars.

Vanaf 1961 praktiseer mnr. De Klerk as prokureur op Vereniging en diens in verskeie hoedanighede in die gemeenskap. Hy is met ingang van 1973 as Professor in Administratiefreg by die Potchefstroomse Universiteit aangestel maar as gevolg van sy verkiesing tot Volksraadslid vir die Kiesafdeling in November 1972, kon hy die betrekking nie aanvaar nie.

Hy het as parlementalid op verskeie Gekose Komitees gedien. Op 3 April 1978 is mnr. De Klerk aangestel as Minister. Sedert dié datum beklee hy op verskillende stadiums die volgende portefeuljes: — Pos- en Telekommunikasiewese, Volkswelns en Pensioene, Sport en Ontspanning, Mynwese en Omgewingsbeplanning en Energie.

As gevolg van die rationalisasie van die sentrale Staatsdiens en hersamestelling van departemente, beklee hy met ingang van 1 Maart 1980 die portefeulje van Minerale- en Energiesake.

Ladies and Gentlemen I now call on the Honourable the Minister of Mineral and Energy Affairs to officially open the Convention.

U Agbare, die Minister van Minerale- en Energiesake.



Sy Edele Minister F. W. de Klerk.



Aberdare and Aycliffe, that's who. We make all the energy transport and distribution cables, ranging from mains voltage to 42kV, necessary to supply the power and to turn on the lights.

And to keep the power flowing, we supply a unique advisory service and after-sales back-up.

## Guess who helped to turn on the lights

In short, now that we've helped to remove the 'darkest' from Africa, we want to make sure the future stays bright.

**in Darkest Africa**



EDENVALE:  
(011) 609-4020  
PORT ELIZABETH:  
(041) 45331

Gerritshill-Enveld 10428

# OPENINGSTOESPRAAK DEUR SY EDELE F. W. DE KLERK, MINISTER VAN MINERAAL- EN ENERGIESAKE

Dit is vir my besonder aangenaam om u toe te sreek en ek bedank u vir die geleentheid wat u my vanweë die aard van u Vereniging bied om 'n paar gedagtes met u te wissel oor 'n aangeleentheid wat baie belangrik is, naamlik energie. In die besonder wil ek graag kortliks die soeklig plaas op die toe nemende vraag na energie en die behoefte aan energiebesparing wat daaruit voortvloei.

Energie het in die onlangse jare seker een van die mees akuele of tersaaklike onderwerpe van ons tyd geword. Dit is so in die eerste instansie omdat energie onmisbaar is vir die meeste vorms van menslike aktiwiteite. In die tweede instansie weet ons dat waar energie voorheen volop en goedkoop was — tensiens die beskikbaarheid daarvan as vanselfsprekend aanvaar is — die posisie in die onlangse tyd heeltemal omgekeer het. Daar bestaan nou groot besorgdhede oor die voldoende beskikbaarheid van alle vorms van energie, en wel in so 'n mate dat energie saam met voedsel vandag as een van die wêreld se grootste probleme beskou word. Dit is derdens inderdaad ook so dat die afgelope jare die aandag vir die eerste keer met felheid gevestig het op die onewerdige verspreiding van konvensionele energiebronne op die aarde en die kwesbaarheid wat hieruit voortspuit. Die vroeëre vas bewustheid hiervan het feitlik coraig verander in 'n byna koersagtige soeke na alternatiewe en oplossings.

Die wêreld en veral die westerse wêreld, het in dié jare tot die besef gekom dat die groei in energieverbruik nie onverpoos kan voortduur nie. Daar word tans wêreldwyd voorraadopnames van die energie-situasie gemaak en beplanning en beleidsdoelwitte word daarvolgens ingestel om die verwagte probleme ten beste te kan hanteer.

Die energiedilemma waarin veral die vrye westerse wêreld hom bevind, is in 'n neutepod plaas deur die gevolgtrekkings van 'n studiegroep bestaande uit energiedeskundiges uit vyftien lander onder die naam "Workshop on Alternative Energy Strategies". Ek wil daardie gevolgtrekkings graag kortliks aan u noem:

Die studiegroep het die haas ongelooftike bevinding gemaak dat die produksie van olie so vroeg soos 1985 nie meer met die toenemende vraag sal kan tred hou nie, selfs al sou die prys in reële terme tot 50 persent bo die huidige vlak styg. Ek bind my nie aan hierdie datum nie, maar glo wel dat wat voorspel word op die laaste teen die jaar 2000 werklikheid sal word. Indien bykomende beperkings op die produksie plaas word, sal effektiewe tekorte vroeër ontstaan met 'n dienoo-eenkomstige korter periode om alternatiewe energiebronne te ontwikkel. Die werlike of ware energiekrisis verskil dus van die oliekrisis van Oktober 1973 en van 1979 in dié belangrike opsig dat dit nie polities geïnspireerd is nie, maar dat dit op 'n algehele wanbalans tussen wêreldvraag- en aanbod van energie berus.

Hierdie tekort-situasie wat voorsien word, sal veries dat die s'eds groeiende vraag na energie in toenemende mate uit ander bronne as olie bevredig moet word, terwyl die gebruik van die nog beskikbare olie-reserwes tot daardie behoeftes beperk sal moet word wat slegs deur olie bevredig kan word.

Verder sal die toenemende vraag na energie verg dat alternatiewe energiebronne dringend ontwikkel word en dat die verandering weg van die wêreld se olie-oorheersende energie-ekonomie onmiddellik 'n aanvang moet neem. Die vooruitsigte vir die aanwending van ander energiebronne is kortliks die volgende:

Kernkrag besit die vermoë om 'n betekenisvolle bydrae tot die totale vraag na energie te lewer, maar 'n algemene aanvaarding van die gebruik daarvan sal nog moet plaasvind. Die gebeure by die kernkragentrale by Three Mile Island in die VSA, het die weerstand teen die aanwending van kernkrag vergroot. Selfs in Suid-Afrika is daar baie mense wat teen die opwekking van kernkrag by oebarg gekant is.

Steenkool het ewe-eens die vermoë om 'n waardevolle groter bydrae tot die wêreld se energiebehoefte te maak; trouens, dit is vandag die enigste bewese, gangbare alternatief op groot skaal. Die wêreld beskik oor ruim steenkoolreserwes maar om die volle voordeel daarvan te benut, sal 'n aktiewe program van navorsing en ontwikkeling vereis.

In globale verband sal aardgas slegs in die verwagte vraag daarna voorsien, indien uitgebreide en kapitaalintensiewe

interkontinentale gas-verspreidingsnetwerke tot stand gebring kan word. Alhoewel die wêreldreserwes ten opsigte van die nie-konvensionele fossielbrandstowwe, soos teersaad en olie-skaal, groot is, sal hierdie bronne slegs 'n geringe bydrae voor die einde van hierdie eeu kan maak. Met die uitsondering van hidrokras, sal die sogenaamde hernieubare bronne soos sonenergie, windenergie en golf- en getye-energie ewe-eens nie 'n betekenisvolle bydrae voor die einde van hierdie eeu kan maak nie.

Verder sal die kritieke interafhanklikheid van nasies ten opsigte van energie-aangeleenthede 'n ongekende samewerking op internasionale vlak in die toekoms vereis. Daarbenewens sal dit nodig wees om kapitaal, arbeid en vindingrykheid te monster op 'n skaal wat ongehoord is in die energiegeskiedenis van die mensdom.

Net so sal verhoging van energieproduksie uit die beskikbare grondstowwe en verbruikersdoeltreffendhede sowel as betekenisvolle besparingspogings ook die vraag na energie kan demp en die gaping tussen vraag en aanbod vernou.

Hierdie bevindings van die werkgroep is ten opsigte van die totale vrye westerse wêreld geformuleer, maar dit is vanselfsprekend dat dit ook in beginsel op Suid-Afrika van toepassing is.

Ons energievoorsieningsposisie verskil ietwat van die ander westerse lande omdat ons oor geen bewese olie-reserwes beskik nie. Gelukkig is ons huidige slegs vir sowat 20 persent van ons primêre energiebehoefte afhankelijk van ingevoerde ru-olie. Aanvullend hier toe sal Saol I, II en III 'n noemenswaardige persentasie van die land se petroleumbehoefte binne enkele jare verskaf. Met die verdere moontlike ontwikkeling en vervaardiging van alternatiewe vloeibare brandstowwe soos die alkohole, sal Suid-Afrika beter in staat wees om die voorspelde tekort aan ru-olie in 'n groot mate die hoof te bied.

Suid-Afrika is ook in die unieke posisie om vir sowat 80 persent van sy energiebehoefte van 'n binnelandse beskikbare energiebron naamlik steenkool afhankelijk te wees. In 1980 is bykans 60 persent van die totale steenkoolverbruik vir die opwekking van elektrisiteit aangewend. Elektrisiteit is 'n gewilde energiedraer weens die relatiewe hoë doeltreffendheid en sinderlikheid in gebruik en is steeds besig om absoluut sowel as relatief tot ander energiedraers toe te neem. Die aandeel van dié energiedraer was in 1978 verantwoordelik vir 20 persent van die totale netto energie of 36 persent van die totale nuttige energieverbruik.

Die toename in die verbruik van energie word deur verskeie faktore bepaal waarvan bevolkingsgroei, peil van ekonomiese ontwikkeling en -groei, verhoging in die graad van meganisasie en die streef na hoër lewensstandaarde sekerlik van die belangrikste is. Suid-Afrika verkeer in dié opsig in 'n unieke situasie. As gevolg van die sameloop van bestaande faktore, neig die sogenaamde energie bruto binnelandse produk elasticiteitskoeffisiënt, wat gedefinieer word as die verhouding tussen die relatiewe verandering in energieverbruik en die relatiewe verandering in ekonomiese groei oor 'n bepaalde periode, om groter as een te wees. As algemene reël is gevind dat hoogs industrialiseerde lande 'n koeffisiënt kleiner as een het. Indien van die veronderstelling uitgegaan word dat die koeffisiënt op die huidige hoë vlak bly en dat die Suid-Afrikaanse ekonomie teen 'n gemiddelde koers van 5,5 per jaar moet groei, om die vinnig groeiende bevolking te akkommodeer, sal dit beteken dat die vraag na energie teen 'n koers van ongeveer 6,7 persent per jaar sal groei.

The question can surely be asked what can be done to alleviate the pressure on the energy sources of South Africa. One of the aspects of the use of energy which is becoming increasingly important, is energy conservation. The effective utilisation of energy and the elimination of waste are considered important priorities for the future. It is, however, also important to realise that energy conservation cannot solve the problem of diminishing energy resources and reserves. Energy conservation should rather be seen as a measure which will facilitate adjustment in an increasingly energy-impooverished world and which will afford technological development the opportunity of coming up with more lasting solutions. Nonetheless — energy conservation remains important — ex-



remely important — and would like to advance a number of arguments to substantiate the need for dedicated effort in that direction.

Firstly it is necessary from a financial point of view. If it is taken into consideration that South Africa spent approximately 15 per cent of the gross national product on energy, a modest energy conservation effort can have a considerable impact.

The energy industry is particularly capital intensive and considerable investment is required to provide for growth in energy consumption. As is generally known, the completion cost of a conversion plant such as Sasol II and III, is more than 5 000 million rand. Due to the considerable escalation in the cost of capital equipment it can readily be expected that the capital cost per unit energy output will increase progressively in future. If the requirements of the energy industry continuously expand at a faster rate than the other sectors of the economy, it is possible that these sectors will be forced to make sacrifices regarding capital and growth. Simultaneously we know that South Africa has other important priorities requiring vast amounts of money. We must therefore save energy to save capital.

Secondly we need to conserve energy from a resource point of view. Energy conservation has a retarding effect on the depletion of energy resources. Although South Africa has reasonably adequate coal reserves at its disposal, they are by no means unlimited. Apart from the steadily increasing domestic demand, coal is becoming a valuable trade commodity and earner of foreign exchange and as such the pressure on coal will steadily increase. We must therefore ensure that our valuable resources are put to the best possible use — and avoid waste.

Thirdly: Due to the often negative and irreversible environmental impact of pollution caused by large-scale energy production, conversion and the consuming industries the rational and reduced consumption of energy can help to maintain the quality of the environment.

Need I expand? How then can we succeed in conserving energy?

A prerequisite for the successful implementation of energy conservation measures, is a knowledge of the various factors which play a role in the energy conservation process and in the second place a positive approach by each and everyone towards energy conservation. The ideal situation which should be aimed at, is the acceptance of energy conservation as a way of life in every sector of the national economy.

Energy conservation measures can be divided into two broad categories. In the first place so-called domestic measures can be taken. These measures can be implemented in the short term and require little or no capital investment. In the second place there are technological measures, which comprise technological improvements and changes in apparatus and equipment and which are of necessity longer term measures requiring capital investment. The member countries of the Organisation for Economic Co-operation and Development for instance, accept that conservation measures can have a beneficial effect even in the short term. These measures are chiefly of a domestic nature and basically involve better energy management.

They estimated that through better energy management and the elimination of wasteful practices, the industrial sector alone, which is by far the most energy-intensive industry, can save about 10 per cent on industrial fuel and 5 per cent on electricity, without affecting output.

Furthermore — in order to put energy conservation on a firm and practical basis in South Africa, specific objectives should be defined for the different consumer sectors, as well as targets in respect of total consumption. It is however, absolutely essential that as many parties as possible, from both the public and private sectors, be involved in the implementation and execution of decisions in regard to energy conservation.

In die geheel gesien, wil ek dus sê dat 'n belangrike element van ons langtermyn-energiebeleid moet wees om energiebesparing in al die sektore van die ekonomie na te streef en aan te moedig sonder om die ekonomie te skaad.

Munisipaliteite is groot afnemers van veral elektrisiteit en u Vereniging is dus in 'n besonder goeie posisie om Suid-Afrika op die gebied van energiebesparing van diens te wees. As ek dit sê, bedoel ek ook nie net die besparing van elektrisiteit

nie, maar ook ons totale inset in die vorm van kapitaaltoerusting en wat daarmee gepaard gaan, om elektriese krag aan die verbruiker te lewer.

In ons huidige verskaffingsopset, is daar sover ek kan sien, nie aansporingsmaatreëls ingebou wat spesifiek op elektrisiteitsbesparing ingestel is nie. Nogensins is daar vir beide die eindgebruiker en die verskaffer ooplopende en versteekte voordele te behaal.

In die nasionale belang, is dit gebiedend noodsaaklik dat ons energie moet bespaar en oormatige kapitaalbesteding aan energieverskaffing moet beperk. Dit is hier waar u brein-krag en entoesiastiese samewerking vir ons van soveel waarde kan wees.

Dit is nodig dat hierdie hoedskap van besparing voortdurend uitgedra word en u kan in die gemeenskappe wat u dien, 'n besondere rol in dié verband vervul. Ek doen dus 'n beroep op u om u in hierdie opsig ook aan die beste belange van die Republiek dienstig te maak.

In soverre u ook in die verskafferslyn aktief is, is daar weer voordele te behaal deur die optimale aanwending van beskikbare toerusting om onnodige kapitaalbesteding wat agterna uit kragverkope goedgemaak moet word, aan bande te lê. So is daar, om 'n ander voorbeeld te noem, elektrisiteitsverwante fasiliteite soos werkwinkelgeriewe, gesofistikeerde toerusting en dies meer — of selfs skaars mannekrag — wat miskien eerder uitgeruil of gedeel kan word as om in isolasie op te tree. Energie lewer 'n basiese inset ten opsigte van ons koste-strukture en naas die ander sake wat ek genoem het, moet ons energiekooste ook so laag moontlik hou. Hoe belangrik dit is blyk uit die feit dat die hoofrede vir Taiwan se belangstelling in gesamenlike ondernemings in Suid-Afrika geleë is in ons relatief lae energiekooste. As ons Suid-Afrika wil sien groei, moet ons kompetend bly in die wêreldmark — en hier toe kan relatief lae energiekooste 'n geweldige bydrae lewer. Aanvaar die uitdaging asseblief. Mag hierdie 47ste Konvensie van u Vereniging 'n bydrae lewer tot die doelwitte wat ek vandag probeer omlin het.

Dit doen my nou groot goed om u hierdie 47ste Konvensie van u Vereniging formeel geopen te verklaar.

**MNR. P. J. BOTES: PRESIDENT**

Baie dankie mnr. die Minister dat u hierdie 47ste Konvensie geopen het. U aanmerkings oor die energieprobleme was uiters insiggewend en dit skilder voorwaar 'n donker prentjie van die toekoms.

Maar mnr. die Minister ek het nou verwag dat u vanoggend van hierdie geleentheid gebruik kan maak om 'n verdere verslapping in die spoedgrens af te kondig maar ons sal maar weer met dieselfde spoed moet terugreis huis toe.

Energy conservation as a way of life can only be implemented if we have full co-operation of everyone concerned. The definition of energy conservation must be properly understood and endorsed by all the people involved, because we have found various interpretations in existence.

Ons sal u uitdaging sterk oorweeg en ons verseker u mnr. die Minister van ons samewerking in dié verband.

U weet u teenwoordigheid hier vandag word hoog waardeer want as Minister moes u verlede week 'n verkiesing veg en vir 'n Minister is so 'n verkiesing nie 'n grap nie want u veg dit nie net in die kiesafdeling nie en om so gou weer in die tuig te wees very harde werk.

Hier is vandag heelwat oud-maties teenwoordig maar ons as Maties gun ook die Universiteit van Potchefstroom hul dae van glorie en mnr. die Minister, alhoewel 'n 'n oud-matie is nie weet ons u is bestem vir groot dinge en wens ons u alle sukses toe in u politieke loopbaan.

Ek is seker die gehoor wil weer eens hul dank en waardering aan u betuig op die gewone manier. As blyk van ons dank oorhandig ek graag aan u 'n das van die Vereniging. Nog-maals baie dankie.

Confidential

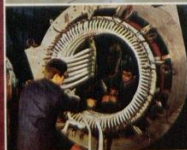
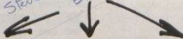
Confidential

ELECTRIFICATION PROJECT

ITDA Immediate Suppliers  
for:

- (a) HV/EF Distribution.
- (b) Control Systems.
- (c) Process Control.
- (d) Large Motors.
- (e) Electronics.
- (f) Installation and Commissioning.

*Steve - Save time, get  
Brown Boveri.*



# BROWN BOVERI,

in electrical  
engineering, in  
every field, the  
name that means  
everything.



**BBC**  
BROWN BOVERI

BROWN BOVERI SOUTH AFRICA (PTY) LTD  
P.O. BOX 1500 JOHANNESBURG 2000  
Telephone (011) 636-5791  
Telegrams 'BROWNBOVERI' • Telex 8-7234 SA

## INDUCTION OF PRESIDENT INHULDIGING VAN PRESIDENT

### MNR. P. J. BOTES: UITTREDENDE PRESIDENT

Ladies and gentlemen, before I move onto the next item I wish to convey my thanks to one and all of you who have made my task as President of this Association such a pleasant one.

I wish to thank the Executive Council and the various committees for their loyal support and hard work.

Dit is 'n behoefte van my hart om hier 'n paar van die belangrike sake te noem wat in hierdie twee jaar aandag geniet het:

1. Die opstelling van 'n nuwe Konstitusie. My dank aan mnr. W. Barnard en die betrokke subkomitee.
2. Die aanvaarding van die SABS Gebruikskode vir die Bedrading van Persele.
3. Die Tegniese Vergadering, Welkom. In hierdie verband woor eens my dank aan mnr. Botha van Welkom en sy personeel, asook die Stadsraad van Welkom vir die daarstelling van die Tegniese Vergadering.
4. Die insameling van fette vir die S.A. Telekommunikasie en Elektriesiteitsvoorsieningsowerheid (SATEKG). My dank aan die verskillende komiteede vir hul werk gedoen en vir die samewerking wat ons van u almal ontvang het.
5. Die daarstelling van beurse aan universiteitstudeute en vakleerlinge.
6. Die betrokkenheid van die VMEQ by die —
  - (i) IFAC-simposium; 15/19 September 1980.
  - (ii) IEK-vergaderings in Sidney, 1979 en in Stockholm 1980.
  - (iii) Wêreldenergiekonferensie, September 1980.
  - (iv) TK 64 — IEK-Subkomitee, Pretoria.
  - (v) Seminare oor nuwe Elektriese Bedradingstelsels. My dank aan mnr. J. K. van Ahlfen wat soos gewooslik die leiding op hom geneem het en mnr. Botha van Bloemfontein, Dawson, Palser en Fraser.
7. Die daarstelling van 'n Gebruikskode vir Aarding. My dank aan almal wat daarby betrokke was asook aan die S.A. Instituut vir Elektrotegniese Ingenieurs vir die werksinkel wat hulle geroef het.
8. Een van die belangrikste aspekte is die stigting van die Vrystaat- en Noordkaaplandtak Hier wil ek graag mnr. Botha van Bloemfontein en mnr. Botha van Welkom bedank vir die leiding wat hulle geneem het in dié verband.

Dan wil ek ook meld dat ek in die loop van my dienstermyne een van die takke van die VMEQ besoek het. Dit was voorwaar aangename ervarings, ek sal die hofflikheid en vriendskap wat ek oral ontvang het nie gou vergeet nie. Die belangrikste aspek wat na vore gekom het by hierdie vergaderings is die lede se bemoeienis om die veiligheid van die publiek te verseker. Dit is voorwaar die hoofsaak by al die besprekings en mnr. die Minister ek kan aan u sê dat die volk van Suid-Afrika baie dankbaar kan wees oor hierdie toegewyde manne, manne wat bereid is om alles moontlik te doen om die veiligheid van die publiek te verseker.

My innige dank aan al die komitees en subkomitees asook aan my vrou wat my altyd bygestaan het. My innige dank gaan ook aan die Sekretaris van die Vereniging, mnr. Bennie van der Walt wat met die begin van my dienstermy ook Burge-meester van Rooodepoort was.

Soos gewoonlik was die reëlings wat hy getref het met die vergaderings, die Tegniese Vergadering te Welkom en die Konvensie by die Randse Afrikaanse Universiteit, puik. Sy bystand en ondersteuning oor die afgelope twee jaar was van onskatbare waarde en hier wil ek ook byvoeg die hulp wat sy vrou Annatjie aan my en my vrou verleen het gedurende hierdie tydperk. Baie dankie Bennie en Annatjie. Langs hierdie weg wil ek ook die Stadsraad van Rooodepoort en die Departement van die Stadsraad van Rooodepoort asook my personeel bedank dat hulle dit vir my moontlik gemaak het om te kon dien as President van hierdie Vereniging.

I wish to thank the officials of the SABS, CSIR, NBRI, ESCOM, the Department of Manpower and Utilization and

last but not least the affiliates. I appreciate your much valued assistance and co-operation in making my term of office such a pleasant one.

I also wish to thank Denis Fraser, President Elect, for his support. As you all know Dennis recovered from severe illnesses aggravated by sabotage attempts on the electrical system of Durban Corporation to organise this Convention which I am sure, due to his uncanny perfectionistic approach, will be a great success. In terms of our Constitution the President Elect automatically becomes the President at the Convention.

I shall fail in my duty if I do not again read the passage Mr. Robson quoted when he seconded Denis Fraser's nomination for the office of President Elect. It reads thus:

"Generally speaking in politics, and in life generally as a rule — you will find some people competent but not loyal. Other people are loyal but not competent, and when you find one that is both competent and loyal, you've found the rarest of gems".

Ladies and gentlemen we can add to this his dogged determination. It therefore gives me great pleasure . . . to place the chain of office on our new President, may I on your behalf extend our good wishes to him and to his good lady Val, for a successful term of office.



Mr. D. H. Fraser, President, together with the Immediate Past President, Mr. P. J. Botes.

### MR. D. H. FRASER: PRESIDENT

Mr. Minister, Madam Mayor, distinguished guests, ladies and gentlemen. I am deeply conscious of the honour which has been bestowed on me by the members of this important Association in electing me to the office of President. Apart from my own personal gratification, the City which I represent shares this honour and with it the opportunity to host this 47th Convention.

It is twenty one years since an engineer in charge of the Durban Electricity Undertaking was last elected President of the AMEU and I am delighted that my predecessor in office, Mr. R. M. O. Simpson, is present with us today as an Honorary Member. I am indebted to him for his assistance and guidance during our professional association over twenty two years.

Looking over the list of eminent City and Town Electrical Engineers who have been at the helm of the AMEU since its inception in 1915, I realise what exalted ranks I have now joined and what a high stand of performance I have to try to live up to. I can only say with honesty and sincerity that I shall do my best with whatever talents God has bestowed upon me and with the assurances of support which I have had from my Afrikaans and English speaking friends and colleagues in the AMEU. I am also indebted to my Council for making it possible for me to accept the duties and responsibilities of Presidency and heads of other municipal departments for their help and support.

Thanks are due to our hardworking Secretary and the loyal, dedicated and enthusiastic group of staff within my Department, ably led by Mr. Alistair Whyte, who have attended to

the multitude of tasks which precede a Convention. On an occasion like this one can, I think, be excused for casting one's mind back over the years and remembering people who, and events which, have influenced one's life and career. I recall with appreciation early guidance and encouragement from teachers at the Durban Technical High School and staff of the University of Natal. In subsequent years the friendship and support of a number of outstanding characters both within and outside the profession of electrical engineering and occupying humble and exalted positions, has been greatly valued. Time does not permit me to name them all.

Finally I must acknowledge with grateful thanks the unstinted help and encouragement which I have always enjoyed from my wife Val over more years than I care to remember. It is now my duty and pleasure to thank Piet Botes, the retiring President, for his outstanding handling of the affairs of the AMEU during the past two years. I have watched his progress from the "ranks" of the Association over the past ten years or so and have been impressed by his growth in stature (and I am not referring to his figure) and wisdom.

Ook die wyse waarop hy die verrigtinge tydens die afgelede Konvensie en die Tegnieese Vergadering in Welkom, asook tydens vergaderings van die Uitvoerende Raad hanteer het, het vir my as voorbeeld gedien en ek het eers onlangs begin besef hoeveel werk en tyd daaraan bestee is.

Danksy 'n belangrike voorwaarde in die Grondwet van die Vereniging sal sy ondervinding en kennis altyd vir hierdie instansie behoue bly en sal ek persoonlik dankbaar wees vir sy voortgesette leiding die volgende twee jaar gedurende sy amp as pas uitgetrede President. Uit erkentlikheid vir sy diens aan die VMEQ is dit vir my 'n voorreg om hierdie welverdiende huldeskrif aan hom te oorhandig.

Piet, ek hoop dat hierdie adres jou altyd sal herinner aan die jare wat jy saam met jou vriende in die munisipale diens verkeer het.

**MNR. P. J. BOTES; ROODEPOORT**

Eaie dankie mnr. die President. Hierdie adres sal beslis 'n ereplek in my huis kry.

## **ELECTION OF PRESIDENT ELECT VERKIESING VAN AANGEWESSE PRESIDENT**

**MR. K. G. ROBSON; EAST LONDON**

Mr. President, before proceeding with my formal duty may I, on behalf of your friends and colleagues in the AMEU, guests, visitors and their ladies congratulate you on your election to the high office of President of the AMEU.

I have no doubt you will add your own lustre to this office and we assure you of our loyalty and our support.

May your two year term of office bring to you and your wife Val new experiences and friendships and the reward that comes from service freely and unselfishly given.

Go well and may God go with you both.

Mr. President, your Worship the Mayor, distinguished guests, ladies and gentlemen, it is for me a privilege and a pleasure to propose as President Elect of the AMEU for 1981/1983 my friend Wessel Barnard, City Electrical Engineer of Johannesburg.

Although some of us have difficulty in accepting it, Wessel Barnard was actually born in the Cape Province — in Villiersdorp.

His school years were spent at Melville School, Helpmekaar Hoërskool and Johannesburg Technical High School. After completing his apprenticeship with the Johannesburg City Council he proceeded on military service with Special Signals — 23 Air Squadron.

Thereafter he attended Witwatersrand University as a bursar of the City Council where he obtained a B.Sc. degree in Electrical Engineering in 1947.

After his pupillage with English Electric in England he re-joined the Johannesburg Electricity Department in 1949 as an Assistant Engineer.

It is fitting to acknowledge publicly his singular and outstanding personal achievement — from Apprentice Electrician to City Engineer of South Africa's largest Municipal Electricity Undertaking.

Stamped indelibly in his memory is the incident which took place three months after his appointment as City Electrical Engineer.

A major explosion occurred in the 275 kV Substation that resulted in millions of rands worth of damage but fortunately no loss of life or injury. The contractors working in the Switch Hall had left only fifteen minutes earlier.

He holds the Government Certificate of Competency and a Post Graduate Diploma in Public Administration, is a Fellow of the Institution of Electrical Engineers (London) and a Fellow and member of the Council of the South African Institute of Electrical Engineers.

For various reasons, it is twenty two years since Johannesburg provided an AMEU President. It is appropriate therefore that the AMEU once again — if belatedly — is able to acknowledge at this 1981 Convention the impressive contribution that the Electricity Department of the Johannesburg City Council has made to the activities and progress of the AMEU and to the electricity industry in South Africa by choosing its present City Electrical Engineer as President Elect.

A man of parts is our Wessel — husband, father, extrovert, raconteur, golfer, bowler, tennis player, bricklayer, gardener, photographer, reader, public speaker, wine expert, non-stop talker — and between times City Electrical Engineer!

As I stand here awed by this impressive list of accomplishments may I be permitted a private moment with Wessel and ask Duncan's famous question from Macbeth Act 1 Scene 2 Line 1!

Perhaps, for those of you who have brought your Shakespeare's with you, I should repeat the reference-Macbeth Act, Scene 2 Line 1!

Those of us who know him well have enjoyed his friendship and his personality.

Wessel Barnard has served the AMEU diligently and with enthusiasm. He has represented Johannesburg on the Highveld Branch for twenty years and has served on the Executive Council since 1975.

I am able to say with conviction that he has a strong commitment to the AMEU and believes in its worth and influence as a national body. Above all he works and will continue to work for it.

Mr. President, ladies and gentlemen, it is now an honour for me formally to propose Mr. Wessel Barnard, City Electrical Engineer of Johannesburg, as President Elect of the AMEU for the 1981/1983 term.

On your behalf I extend to Wessel and his charming wife Iona our affectionate good wishes.

Thank you.

**RDL. C. VENTER; JOHANNESBURG**

Meneer die President, geagte Burgemeester van Durban, hoogwaardigheidsbekleers, afgevaardigdes, dames en here. Laat my toe om net namens die Stad, Johannesburg vir u geluk te wens met u inbulding hier vandag. Ons glo dat u baie goed sal presteer en dat u 'n baie waardige President sal wees.

Meneer, die President, dit is vir my 'n besondere voorreg om die nominasie as Aangewese President van mnr. Wessel Barnard te sekondeer. Hy het in 1939, 41 jaar en 3 maande gelede begin met sy vakleerlingskap by die Stadsraad van Johannesburg. Een en twintig jaar gelede het die Elektrotegniese Stadsingenieur van Durban, die President van hierdie Vereniging geword en toe het die Elektrotegniese Stadsingenieur van Johannesburg hom opgevolg en hier gaan dit nou blykbaar weer herhaal word. Nou wet ek nie of daar eintlik so 'n ooreenkomst is of dat dit 'n gewoonte is.

Wessel Barnard's life is truly a log cabin to White House story. He is one of the very few men who rose from the position of apprentice electrician to City Electrical Engineer in the same Undertaking. His whole career in the City Council of Johannesburg was one of success. He was appointed Assistant Engineer, five years later, in 1954, Methods Development Engineer; four years later, Administrative Engineer; Chief Distribution Engineer three years later, Assistant General Manager three years later; Manager, Maintenance and Operating five years later and six years later, in 1975, he became City Electrical Engineer of what I believe is the biggest Municipal Electricity Undertaking in the Republic of South Africa.

Mr. President that his technical background and all the other qualities that he does possess, make him an admirable candidate for President Elect of the AMEU and I therefore have no hesitation in seconding the nomination of Mr. Wessel Barnard, City Electrical Engineer of Johannesburg, as the President Elect for the ensuing period.

#### MR. D. H. FRASER: PRESIDENT

Mr. Barnard has been duly proposed and seconded. Are there any other nominations for the post? If not, I have much pleasure in declaring Wessel Barnard duly elected as President Elect of the AMEU for the period 1981-1983 and would ask him please to come forward and take his place at the main table.

Mr. Barnard is a man of many parts, as we have heard, and describing all those parts has taken quite a long time, but nevertheless I'll give him the opportunity of saying a few words to you and place the entire blame on him if you find your tea cold.

#### MR. W. BARNARD: JOHANNESBURG

Mr. President, I wish you all the happiness and success in your office as President. I assure you that it will be my privilege, to which I am looking forward, to work with you during the next two years.

Dit is vir my ook 'n groot eer om hier te staan as aangewese-president en ek wil my dank en waardering uitpreek teenoor al die lede van die VMEQ vir hierdie besondere eer wat hulle my vanmôre hier aangedoen het.

I would like to express my most sincere appreciation to Ken Robson, not only for his remarks, but also for his friendship and advice over the years.

Aan my Voorsitter, Raadslid Carel Venter, baie dankie ook vir u opmerkings en ondersteuning. Ook wil ek my dank uitpreek aan die Voorsitter van die Bestuurskomitee van Johannesburg, Raadslid Oberholzer vir sy ondersteuning en vir sy teenwoordigheid hier vanmôre.

It is also a very particular honour to the City of Johannesburg, which last provided the President 22 years ago when Bobby Kane was elected.

Thank you, Mr. President and Members for a very great honour.

#### MR. D. H. FRASER: PRESIDENT ORBITUARY: WALTER MILTON

Gentlemen, the first duty I have this morning is not a very pleasant and that is to announce the death of Mr. Walter Milton, a former Honorary Member of the AMEU and somebody who has contributed a great deal to the proceedings of our Association over many years. He passed away recently and I would ask if you would please stand for a moment in a mark of respect.

Thank you.

### GREETINGS GROETE

#### MNR. P. J. BOTES: ROODEPOORT

Meneer die President, ek het 'n paar briewe ontvang. Een is van Dr. Straszacker en ek lees dit graag.

„Geagte heer, — Graag dra ek my groete en beste wense aan u oor vir 'n uiters geslaagde Konvensie. Dit spyt my iniglik dat ek weens 'n onlangse hartaandoening u Konvensie nie sal kan bywoon nie. Ek het besonder daarna uitgesien en hoop kan vertrou nou dat ek wel die volgende samekoms met u sal kan meemaak.

Mag u berandslagings vrugbaar wees in die groot werk wat u en u organisasie vir ons land doen. Met allerbeste wense”. Die volgende brief is ontvang van mnr. Chris Lombard, ook 'n erelid.

“Dit spyt my dat ek nie die Konvensie van die VMEQ sal kan bywoon nie, aangesien ek dan in die VSA sal wees.

Sal u asseblief my gelukwense aan die uitgetrede President, mnr. P. Botes oordra met die voltooiing van 'n uiters suksesvolle en vrugbare ampstermyn en aan die inkomende president, mnr. D. Fraser, met sy verkiesing as president, asook my wense dat hy 'n suksesvolle ampstermyn sal hê. Ten slotte wens ek die VMEQ en almal wat daarby gemoeid is, 'n baie suksesvolle Konvensie toe”.

#### MR. W. BARNARD: JOHANNESBURG

Mr. President, I have been asked by the President of the South African Institute of Electrical Engineers, Mr. Grant Park, who is unable to attend, to represent him here and convey to you and to the Association, the Institute's very best wishes for a successful conference.

#### MR. D. H. FRASER: PRESIDENT

I would like to mention that I have had a telegram from Mr. Bob Barton, Honorary Member extending his greetings to the Convention.



Mr. Wessel Barnard



## 1. INTRODUCTION

The addresses of most Presidents of this Association over the years form a valuable historical record of the growth and development of electrical engineering in the municipal sphere. I am therefore conscious of a responsibility to posterity to comment upon certain events of the immediate past which have required attention by or influenced the thinking of municipal Electrical Engineers.

Like the poor, it seems that some of the problems will be with us always as, for example, the chronic shortage of technical staff. The severity of the problem will, however, vary with prevailing circumstances and the upsurge in economic activity in South Africa of the past 18 months or so has strained technical manpower resources almost to breaking point.

In respect of some of our concerns it is encouraging to realise that change is constantly taking place and given time things have a tendency to sort themselves out to a lesser or greater degree. For example, I quote from Mr. Ken Robson's Presidential address in 1977 — "the drop in the price of gold, the depletion of our foreign reserves and the reduced flow of external capital has brought our country to a position that appears in retrospect impossible to have imagined . . . two years ago." Today the picture is far more attractive in these regards although it must be acknowledged that many other problems mentioned by Mr. Robson are with us still. Included in these are the continuing rise in oil price and spiralling inflation.

The reports of the Wiehahn and Riekerk Commissions will have their impact on employment practices and labour relationships in municipal undertakings and will hopefully, in the longer term, help to solve the technical manpower shortage problem. Acceptance at grass roots level of new concepts of equality of opportunity for all and advancement on merit alone will, understandably, not occur overnight and considerable wisdom and tact, coupled with boldness, will be required by all concerned during the implementation of the Commission's recommendations.

Another report of relevance to suppliers of electricity in the Republic is that of the Board of Trade & Industries No. 1889 "Investigation into the tariff policy and tariff structure in respect of the supply of electricity in South Africa." This was instituted by the Minister of Economic Affairs in March 1977 following reaction from various quarters to sharp increases in Escom tariffs in 1976. However, the investigations and recommendations of the Board of Trade were not confined to Escom and some are of real concern to municipal suppliers of electricity.

In the field of education and training an important document was released during 1978 by a Committee appointed by the Minister of National Education under the chairmanship of Mr. R. C. J. Goode. Its report concerns the training, use and status of Engineering Technicians in the Republic of South Africa. The Committee visualises two streams of engineering education in the Republic namely the professional engineer trained in a university with a thorough appreciation of the fundamentals of mathematics and the sciences and the engineering technologist whose education and training is more directly career-orientated and directed towards a specific field of activity. The training of the engineering technologist is seen to be the function of the colleges for advanced technical education now known as Technicons which, it was recommended, "should preserve their own identity completely distinct from universities, and steadily improve their stature by raising their own standards." The engineering technologist has an important role to play in the electricity supply industry and it is hoped that the implementation of the Goode Committee's recommendations will place his academic and practical training on a firmer foundation and result in the

## 1. INLEIDING

Die voorsitteringsrede wat al in die verlede deur presidente van hierdie Vereniging gehou is maak 'n betekenisvolle deel uit van die groei en ontwikkeling van elektrotegniese ingenieurswese op die munisipale gebied. Ter wille van die nageslag beskou ek dit dus as my plig om enkele woorde te sê oor sekere onlangse gebeure wat nie alleenlik die aandag van munisipale ingenieurs geveer het nie maar ook 'n invloed op hul denkwysing gehad het.

Net soos die armes altyd 'n probleem in die samelewing sal wees, so sal ons maar altyd met sekere probleme te kampe hê, soos byvoorbeeld die ernstige tekort aan tegniese personeel. Die erns van die probleem sal egter verander na gelang van huidige omstandighede en die snelle toename in ekonomiese bedrywigheide in Suid-Afrika die afgelope 18 maande het die tegniese mannekrag byna geheel en al uitgeput.

Met betrekking tot sommige van die probleme wat ons ondervind, is dit bemoedigend om te weet dat daar wel verandering intree en dat alle probleme mettertyd tog op die een of ander wyse opgelos word. As voorbeeld haal ek 'n gedeelte aan uit mnr. Ken Robson se voorsittersrede van 1977 — "die daling in die goudprys, die uitgeputte buitelandse reserwefondasies en die afname in eksterne kapitaal het daartoe bygedra dat ons land nou tans bevind in 'n situasie wat twee jaar gelede onmoontlik sou geklink het." Ofskoon die toedrag van sake tans geheel en al anders is, moet ons erken dat ons nog steeds met baie van die ander probleme wat mnr. Robson genoem het, te kampe het. Die voortdurende olieprysstygings wat gepaard gaan met inflasie het onder hierdie probleme.

Die versae van die Wiehahn- en Riekerk-kommissie sal 'n groot invloed op werk en werkverhoudinge in munisipale ondernemings hê en sal heel waarskynlik baie daartoe bydra om op die lange duur die probleem betreffende die tekort aan tegniese personeel op te los. Die algehele aanvaarding van nuwe begrippe betreffende gelyke geleenthede vir almal en bevordering alleenlik aan die hand van meriete sal natuurlik nie oorag geskied nie en 'n groot mate van wysheid en geduld asook durf sal vereis word van iedereen wat met die implementering van die Kommissie se aanbevelings gemoed is.

Nog 'n verslag wat op voorsieners van elektrisiteit in die Republiek betrekking het, is dié van die Raad van Handel en Nywerheid nr. 1889, "Onderzoek na die tariefbeleid en -struktuur van toepassing op die voorsiening van elektrisiteit in Suid-Afrika." Hierdie ondersoek is in Maart 1977 gelas deur die Minister van Ekonomiese Sake nadat daar vanuit verskeie oorde gereageer is op die skerpe stygings in die Evkomtariewe in 1976. Die ondersoek en aanbevelings van die Raad van Handel het egter nie alleenlik op Evkom betrekking gehad nie en sommige hiervan het veral betrekking op munisipale elektrisiteitsvoorsieners.

'n Belangrike dokument op die gebied van opvoeding en opleiding is gedurende 1978 beskikbaar gestel deur 'n komitee aangewys deur die Minister van Nasionale Opvoeding onder die voorsitterskap van mnr. R. C. J. Goode. Voormalige komitee se verslag het betrekking op die opleiding, benutting en status van ingenieurstegnici in die Republiek van Suid-Afrika. Twee tipes opleiding van ingenieurs in die Republiek word deur voormalige komitee in die vooruitsig gestel, te wete die professionele ingenieur wat sy opleiding aan 'n universiteit ontvang waar hy deeglike kennis opdoen van die basiese wiskundige en wetenskaplike begrippe en die ingenieurs-tegnoloog wie se opvoeding en opleiding meer gemik is op 'n spesifieke loopbaan en werkgebied. Die opleiding van ingenieurstegnoloë word beskou die funksie van kolleges vir gevorderde tegniese opleiding te wees wat tans bekend staan as Technicons wat, soos daar aanbeveel is, hul eie identiteit behoort te behou in teenstelling met universiteite en geleidelik hul status moet verhoog deur hul eie standaarde te verbeter. Die ingenieurstegnoloog het 'n belangrike rol in die elektrisiteitsvoorsieningsbedryf en die hoop word gekoester dat die implementering van die Goode-komitee se aanbeve-

attraction of increasing numbers of young men and women into this career.

It is gratifying to be able to record that tangible progress is now being made in regard to the electrification of Soweto and those responsible for overcoming the initial problems of the financing of this enormous project deserve our congratulations. It is interesting to note the significant investment in the scheme by the South African Post Office. There are, I am sure, still many problems both technical and social, to be overcome in regard to the Soweto scheme and perhaps some of these could usefully be discussed at our next Technical Meeting. Apart from the improvement in the quality of life which the availability of electricity will bring to Soweto residents, the stimulus provided to manufacturers of domestic appliances, wiring accessories and distribution equipment will be noticeable and opens up much needed employment opportunities.

## 2. TRAINING AND RETENTION OF STAFF

The report of the AMEU Technical Training Committee provides factual information on developments in respect of training and retention of staff by municipalities during the past two years.

The survey conducted among all member undertakings in October 1979 revealed a highly unhealthy situation in many large and small municipalities and the staff shortage situation can only have deteriorated since that date on account of the upsurge in the economy. The AMEU Executive Council recognises the seriousness of the problem and has submitted a memorandum on the subject to the United Municipal Executive.

As I mentioned earlier, this particular problem is one with which we have lived for a long time and is repeatedly referred to in the proceedings of the AMEU over the years. It is, of course, not confined to municipalities or to the electrical industry and we all know that the country faces a severe shortage of technical manpower.

It is clear from a report on Professional Engineering Manpower Demand & Supply, published in May 1979 by the Federation of Societies of Professional Engineers, that the shortage in respect of professional engineers affects all disciplines. In the mining sector in the year 1976 only 40% of vacancies were filled by the supply of professionally qualified engineers, while Civil Engineering fared best with 70% vacancies filled. It was predicted that by 1981 there could well be a demand for 2 150 engineers a year of whom 950 will not be found unless there are marked changes in past trends.

It is also clear from the AMEU survey that the shortage of technical staff in the municipal service is not confined to the professional ranks, for staff with acceptable semi-professional technical qualifications are equally difficult to recruit and retain. At the time of the survey there were 75 vacancies in this category, representing a 24% shortage of total requirements. The corresponding figures in respect of professionally qualified electrical engineers were 73 vacancies or 25% of the establishment.

In the matter of staffing in this situation of national shortage, municipal electricity undertakers find themselves at a particular disadvantage. On the one hand the work load is something over which they have no control and the demands for new and increased supplies simply have to be met. At the same time the existing plant has to be maintained and renewed in order to minimise breakdowns and supply interruptions and ensure safety to operating personnel and the public. These obligations and responsibilities cannot be avoided — the service must be provided in spite of the difficulties. As Mr. Alewyn Burger put it to the Institute of Town Clerks in June 1973:

"A manufacturer can always say: 'If I cannot get the quality and quantity of staff that I need at rates of pay

lings daartoe sal hydra dat sy akademiese en praktiese opleiding op 'n gesonder grondslag sal geskied en daartoe sal lei dat al hoe meer jong manne en vroue hierdie beroep as loopbaan sal kies.

Dit is vir my aangenaam om te meld dat daar tans beslis vooruitgang gemaak word met betrekking tot die elektrifisering van Soweto en groot lof kom daardie persone toe wat gehelp om probleme wat aanvanklik met die finansiering van hierdie reuseprojek ondervind is, te oorbied. Dit is veral interessant om te let op die noemenswaardige belegging wat die Suid-Afrikaanse Poswese in die projek gemaak het. Ek is daarvan oortuig dat daar nog heelwat probleme, sowel tegniese as sosiaal, met betrekking tot die Soweto-projek sal opduik en sommige hiervan sal dalk tydens ons volgende Tegniese Vergadering bespreek kan word. Afgesien van die feit dat die voorsiening van elektrisiteit aan Soweto die lewensstandaard van die inwoners op 'n hoër peil sal plaas, sal dit as groot aansporing dien vir die vervaardigers van huishoudelike toestelle, bedradingsbybehore en distribusietoerusting wat sal lei tot die beskikbaarstelling van veel gesoekte werkgeleenthede.

## 2. OPLEIDING EN BEHOUD VAN PERSONEEL

Die Verslag van die VMEQ se Komitee insake Tegniese Opleiding bevat feitelike gegewens oor ontwikkeling op die gebied van die opleiding en behoud van personeel deur munisipaliteite die afgelope twee jaar.

Die opname wat in Oktober 1979 onder alle lidondernemings gedoen is, het aan die lig gebring dat daar benarde omstandighede in baie groot en klein munisipaliteite heers en dat die probleme betreffende personeeltekort alreeds sedert voormelde datum kom vererger het vanweë die bloei in die ekonomie. Die Uitvoerende Raad van die VMEQ is terdê bewus van die erns van die probleem en het 'n memorandum in dié verband aan die Verenigde Munisipale Bestuur voorgelê.

Soos ek alreeds daarop gewys het, het ons al baie jare met hierdie probleem te kampe en daar word telkens daarna verwys tydens die verrigtinge van VMEQ-kongresse. Dit is eger nie alleenlik binne munisipaliteite of die elektrisiteitsbedryf waar soortgelyke probleme opduik nie en is almal bewus van die feit dat die land binnekort 'n ernstige tekort aan tegniese mannekrag sal hê.

Dit blyk duidelik uit 'n verslag wat in Mei 1979 deur die Federasie van die Verenigings van Professionele Ingenieurs uitgegee is oor die Vraag en Aanbod betreffende Professionele Ingenieurs dat die tekort aan professionele ingenieurs 'n uitwerking het op alle dissiplines. In 1976 is daar binne die mynsektor slegs 40% van die vakatures vir professioneel opgeleide ingenieurs gevul teenoor 70% van die vakatures vir siviele ingenieurs. Daar is voorspel dat daar teen 1981 heel waarskynlik jaarliks 'n vraag na 2 150 ingenieurs sou wees, waarvan 950 nie gevind sou kon word nie tensy drastiese veranderinge in die tendense van die verlede intree.

Uit die VMEQ-opname blyk dit ook duidelik dat die tekort aan munisipale tegniese personeel nie net op die professionele vlakke voorkom nie maar dat dit ewe moeilik is om personeel met aanvaarbare, half-professionele tegniese kwalifikasies te werf en te behou. Ten tyde van die opname was daar 75 vakatures in hierdie kategorie, wat 'n tekort van 24% aan totale personeel verteenwoordig. Hierteenoor was daar 73 vakatures vir professioneel gekwalifiseerde elektro-tegniese ingenieurs, d.w.s. 25% van die diensstaat.

Met betrekking tot die aanstelling van personeel in hierdie situasie van nasionale mannekragtekort word die grootste probleme in hierdie verband deur elektrisiteitsondernemings self ondervind. In die een opsig is die hoeveelheid werk wat verrig moet word iets waaroor hulle geen beheer kan uitoefen nie, terwyl daar net eenvoudig in die toemennende vraag na elektrisiteit voorsien moet word. Daarbenewens moet die bestaande aanleg onderhou en versien word om bedryfstuuring en kragonderbrekings tot 'n minimum te beperk en die veiligheid van sowel bedryfspersoneel as die publiek te verseker. Hierdie verpligtinge en verantwoordelikhede kan nie verniy word nie — die diens moet ten spyte van die probleme gelewer word. Mnr. Alewyn Burger het dit in Junie 1973 as volg aan die Instituut van Stadskerke gestel:

"'n Vervaardiger kan altyd sê: 'As ek nie die gehalte of getal personeel wat ek nodig het kan aanstel teen sonda-



which will enable me to make a profit, I cut down on production.' A local authority cannot help this. It simply must render the essential services."

Mr. Burger went on to say that on the grounds of its unavoidable responsibility to the public, the local authority could claim the right to outbid all other employers for staff. He concluded that this would result in general wage increases to outbid the local authority in a struggle for staff which the local authority could not win and which the country could not afford.

No doubt this is true to a degree but it is equally true that rewards and remunerations offered to municipal employees must be sufficiently competitive with the private sector and other public authorities to ensure that local authorities get a fair share of the limited staff available. In this the local authority is faced with the control exercised by Administrators in the four provinces over the salaries of Town Clerks which, in turn, generally regulate the salaries of the heads of all other Departments, including the head of the electricity undertaking.

This artificial restraint on the remuneration of the top officials in the municipalities has had the effect of lowering the whole salary gradient to a degree where the additional monetary reward on promotion very often does not compensate for the increased responsibilities of the higher post. This can result in lowering of motivation of staff at all levels and a lowered spirit of competition within the organisation.

In his Presidential Address to the S.A. Institute of Electrical Engineers in February 1978 entitled "Political Engineering," Mr. K. A. H. Adams attributed the shortage of engineers, technicians and artisans to the lack of promotional possibilities in the engineering occupations. In a mathematical and scientific treatment of the subject he demonstrated the importance of the income gradient, a measure of the prospects of financial advancement of an individual in a group of activity, in relation to political stability in a country, social happiness, economic prosperity and the desire to progress as an aim in life. In advocating a policy for South Africa he expressed the opinion that —

"Bad advice to the Government has resulted in three fundamental misconceptions which have hampered South Africa's development in recent years. The three misconceptions are:

- (i) That the South African income distribution is one of the most unequal in the world, whereas it is one of the most egalitarian.
- (ii) That steps should be taken to improve conditions by equalising incomes, whereas this would worsen the situation.
- (iii) That the low salaries accepted by top public servants are indications of commendable patriotism, beneficial to the country and anti-inflationary, whereas precisely the opposite is true."

Mr. Adams went on to say that the income gradients in the Public Service would have to be increased and top salaries elevated several fold. He added:

"The widely-held view that the Public Services cannot compete with the private sector only applies when income gradients are low. With steep income gradients, the Public Service is in a better position by far and will find it easier to retain its staff."

In his view the salary pattern in a department is the fundamental catalyst which will engender improved performance.

nige salarise as wat my in staat sal stel om 'n wins te maak nie, verminder ek net die produksie.' 'n Plaaslike owerheid kan dit nie sê nie. Hy moet met eenvoudige die nodige dienste lewer."

Voorts het mnr. Burger gesê dat 'n plaaslike owerheid vanweë sy onvermydelike verantwoordelikheid teenoor die publiek, daarop geregtig is om voorkeur bo ander werkgewers met betrekking tot die werwing en aanstelling van personeel te hê. Ter afsluiting het hy gesê dat dit tot verhoogde salarise sal lei ten einde die plaaslike owerheid te oortref met betrekking tot die probleem van personeel, naamlik 'n saak waarteen die plaaslike owerheid nie opgewasse sou wees of die land nie sou kon bekostig nie.

In 'n sekere sin is dit heel waarskynlik die geval, maar dit is ook net so waar dat belonings en salarise wat aan munisipale werknemers aangebied word, met dié van die private sektor en ander openbare owerhede sal moet kan meeding om te verseker dat plaaslike owerhede ook hulle regverdige deel van die beperkte personeel bekom. In hierdie verband het die plaaslike owerheid te kampe met die beheer wat deur die Administrateur van die vier provinsies uitgeoefen word oor die salarise van stadsklerke wat weer in die algemeen die salarise van die hoofde van alle ander departemente beïnvloed, insluitende die hoof van die elektrisiteitsonderneming.

Hierdie kunsmatige inkorting van die salarise van hooggeplaaste amptenare in die munisipaliteite het tot gevolg gehad dat al die salarisskale afgemeen het tot 'n vlak waarop die bykomende salaris wat met bevordering betaal word dikwels nie vir die bykomende verantwoordelikhede van die hoër pos vergoed nie. Dit kan 'n afname van sowel die motivering van personeel op alle vlakke as die meedingingsgees binne die bedryf tot gevolg hê.

Mnr. K. A. H. Adams het in sy voorsittersrede (getiteld "Political Engineering") toe hy die S.A. Instituut van Elektrotegniese Ingenieurs in Februarie 1978 toegesprek het, die tekort aan ingenieurs, tegnisië en ambagslui toegeskryf aan die gebrek aan bevorderingsmoontlikhede in die ingenieurs-beroep. In 'n wiskundige en wetenskaplike behandeling van die onderwerp het mnr. Adams die belangrikheid bewys van die inkomestruktuur, naamlik 'n aanduiding van die vooruitsigte ten opsigte van verhoogde inkomste van 'n individu binne 'n aktiwiteitsgroep, in verhouding tot die politieke stabiliteit in 'n land, maatskaplike welsyn, ekonomiese vooruitgang en die begeerte na vooruitgang as een van die doelstellings in die lewe. Die volgende was mnr. Adams se standpunt in sy aanbeveling van 'n beleid vir Suid-Afrika —

"Die verkeerde advies wat aan die regering gegee is, het gelei tot drie grondliggende wanbegrippe wat Suid-Afrika se vooruitgang die afgelope jare belemmer het. Die drie wanbegrippe is —

- (i) dat Suid-Afrika se inkomsteverdeling een van die mees ongelyke ter wêreld is, terwyl dit eintlik een van die mees egalitiese verdelings is;
- (ii) dat stapte tot verbetering van toestande gedoen behoort te word, terwyl dit net die situasie sal vererger; en
- (iii) dat die lae salarise wat deur hooggeplaaste staatsamptenare aanvaar word tekens is van prysenswaardige vaderlandse liefde en dat dit sowel tot die land se voordeel strek as dat dit inflasie teiwêr, terwyl juis die teenoorgestelde waar is."

Voorts het mnr. Adams gesê dat nie net die inkomsteverhoudings in die Staatsdiens verhoog sal moet word nie maar ook die maksimum salarise. Hy het hierby gevoeg —

"Die alom aanvaarde standpunt dat die Staatsdiens nie met die private sektor kan meeding nie, is slegs van toepassing in gevalle waar inkomsteverhoudings laag is. Indien die Staatsdiens se inkomsteverhoudings 'n toename sou toon, sou hierdie instansie voorrang op elke gebied geniet en sou hy makliker daarin slaag om sy personeel te behou."

Na mnr. Adams se mening is die salarispatroon in 'n departement die grondliggende katalisermiddel om verbeterde werkverrigting in die hand te werk.

While it may not be decisive there can be little doubt that promotional prospects and the possible ultimate financial rewards must play an important part when it comes to the choice of a career.

What is the answer to the staffing problem? Obviously it is not just a question of pay, though this is important. Equally obvious is the fact that the solution will not be found in the short term, taking into account the period of time taken to produce an engineer or technician and the period of practical training necessary before he is fully productive. In spite of this, however, a stepped-up programme of training is a first priority and it is incumbent upon all municipalities to play their part in this by offering loans or bursaries for university degree courses and learnerships for technician sandwich courses. The AMEU Executive Council has recently moved in this direction and the Association now offers two bursaries a year valued at R1 000 each to electrical engineering students at universities in South Africa.

The recommendations of the Wiehahn Commission will widen the field of recruitment of technical staff and it is essential that local authorities should look to all sectors of the community for suitable training material. It remains to be seen to what extent non-whites in the Republic will be attracted to electrical engineering as a profession. In Durban we have had encouraging results in the training of Indians as electricians; 26 having completed their apprenticeship since the commencement of the scheme in 1972. Due to an extremely good response to advertised vacancies it has been possible to be very selective in the appointment of apprentices and it has been our experience that approximately 60% of Indian apprentices earn maximum remission in the duration of their training, through academic attainment and success in the trade test. It seems probable that a fair proportion of the Indian apprentices will progress sufficiently in their studies to be appointed to posts of Engineering or Technical Assistant in the future, thus providing some much needed relief in the semi-professional ranks. Unfortunately, university loans offered to Indians each year since 1975 have met with poor response and only one student has completed his training and taken up employment in the Department. One further student has been granted financial assistance and is in his final year of study.

The reason for the apparent lack of popularity of electrical engineering (particularly heavy current) as a professional career among university students from the local Indian community is not clear but it may be associated with a lack of appreciation of the job opportunities in this field.

A start has more recently been made in the training of apprentices from the Coloured race group and it is anticipated that this sector of the community will be able to make a worthwhile contribution towards the easing of the technical manpower shortage at all levels in the future.

Results in the training of Africans as electrical workers under the Black Building Workers' Act No. 27/1951 have been less rewarding in that their progress has been somewhat slower than other trainees. This may be due to the lack of familiarity with things of a technical nature in their home environment and will probably change in the course of time. It is anticipated that the fuller integration of training of Black apprentices with other race groups following the Wiehahn Commission's recommendations will have a beneficial effect, in that training of the Blacks will not be confined to the African Townships, where facilities for training and the scope of the work undertaken is somewhat limited. The need to train adequate numbers of Blacks in all facets of electrical engineering associated with electricity distribution becomes all the more urgent with the electrification of Soweto and other large African townships.

It does not appear that the short-term needs of the country in professional and semi-professional technical staff can be met without an increase in overseas recruitment and it would seem that municipalities will be forced to explore this avenue

Ofskoon dit nie deurslaggewend is nie, bestaan daar geen twyfel dat bevorderingsmoontlikhede en die moontlikheid van toekomstige verhoging van die allergrootste belang is wanneer daar op 'n toekomstige beroep besluit word.

Hoe kan die personeelprobleem opgelos word? Dit is oënskynlik nie net 'n kwessie van salaris nie, hoe belangrik dit ook al is. Eweneens kan daar nie 'n korttermynoplossing hiervoor gevind word nie, veral met inagneming van die studietydperk wat vereis word alvorens 'n student hom kan bekwaam vir ingenieur of tegnikus asook die nodige praktiese opleidings-tydperk alvorens by maksimum produktiwiteit bereik. Ten spyte hiervan kan 'n verbeterde opleidingsprogram as prioriteit beskou word en is dit die plig van alle munisipaliteite om hierdie by te dra deur lenings of beurse aan te bied vir universiteitsgraad- en stapelkursusse. Die Uitvoerende Raad van die VMEOM het onlangs stappe in hierdie rigting gedoen en daar word tans jaarliks twee beurse van R1 000 elk deur die Vereniging aangebied aan studente in die elektrotegniese ingenieurswese aan Suid-Afrikaanse universiteite.

Die aanbevelings van die Wiehahn-kommissie sal baie hydra tot die werwing van tegniese personeel en dit is belangrik dat plaaslike owerhede by alle sektors van die gemeenskap om geskikte opleidingsmateriaal aankoop. Daar moet nog be-wys word in hoe 'n mate Nie-blankes in die Republiek aangetrokke sal voel tot elektrotegniese ingenieurswese as 'n beroep. In Durban was daar bemoeidige uitlaas met die opleiding van Indiers as elektrisiërs; 26 het hul vakleerling-skap voltooi sedert die projek in 1972 ingestel is. Dit was vanweë 'n uiters goeie reaksie wat op geadverteerde vak-tuurs ondervind is moontlik om baie kieskeurigheid met die aan-stelling van vakleerlinge te wees en ondervinding het ons geleer dat ongeveer 60% van die Indiërvakleerlinge die mak-simum getal maande van hul opleidingstydperk kwytgeskeld word op grond van akademiese bekwaamhede en deur hul ambagstoets met sukses af te lê. 'n Groot aantal Indiërvakleerlinge sal heel waarskynlik hul studies met genoeg sukses in die toekoms voltooi om in betrekking as ingenie-urs of tegniese assistente aangestel te word en sodoende die ern-stige personeeltekort op half-professionele gebied in 'n sekere sin op te los. Daar is ongelukkig nie veel reaksie op un-versiteitlenings wat nog elke jaar sedert 1975 aan Indiers aan-gebied word nie en slegs een student het die opleidingskursus voltooi en 'n betrekking in die Departement aanvaar. Finansiële hulp is ook aan nog 'n student verleen en hy is tans in sy finale studiejaar.

Ofskoon dit nie duidelik is wat die presiese oorsaak is vir die oënskynlike ongewildheid van elektrotegniese inge-nieurswese (veral in die rigting sterkstroom) as 'n beroep onder universiteitstudente uit die gelede van die Indiërgemeenskap, is dit moontlik dat dit verband hou met die feit dat die werksmoontlikhede op hierdie gebied nie waar-deer word nie.

Daar is onlangs 'n begin gemaak met die opleiding van vakleerlinge uit die gelede van die Bruin bevolkingsgroep en daar word verwag dat hierdie sektor van die gemeenskap in staat sal wees om in die toekoms aansienlik op alle vlakke by te dra tot die oplossing van die probleem betreffende mannekragttekort op tegniese gebied.

Daar is minder sukses behaal met die opleiding van Swartes as elektrotegnici kragtens die Wet op Swart Bouwerkers nr. 27 van 1951 aangesien hulle ietwat stadiger gevorder het as ander leerlinge. Dit kan toegeskryf word aan hul gebrek aan kennis omtrent enige saak van 'n tegniese aard in hul huishoudelike agtergrond, 'n situasie wat heel waarskynlik mettertyd sal verander. Na verwagting sal die hoër graad van integrasie tussen Swartes en die ander bevolkingsgroepe tydens die opleiding van vakleerlinge, soos deur die Wiehahn-kommissie aanbeveel, voordelige gevolge hê aangesien Swartes nie net in die Swart dorpe opleiding sal ontvang waar daar ontoereikende geriewe asook werksmoontlikhede is nie. Vanweë die elektrifisering van Soweto en ander groot Swart dorpe word dit al hoe noodsaakliker dat groter getalle Swartes opleiding in alle faette van elektrotegniese ingenieurswese wat in verband staan met elektrisiteitsdistribusie behoort te ontvang.

Dit wil nie voorkom asof daar in die land se korttermyn-behoefte aan professionele en half-professionele tegniese personeel voorsien kan word sonder dat personeel in die buite-land gewerf word nie en dit blyk asof munisipaliteite gedwing

of recruitment. We, in Durban, have had very limited success in previous attempts in this direction and it is obvious that salaries and conditions of employment must be demonstrably superior to those prevailing overseas before one can hope to compete in the international market for staff. If, in the event, municipalities are able to attract engineers and technicians from overseas, they will only retain them for a limited period if salary levels are not competitive with local industry.

### 3. THE GOODE COMMITTEE REPORT

In response to a resolution at the Sixth Conference on the Education and Training of Engineers organised by the Federation of Societies of Professional Engineers (FSPE) in August, 1973, the Minister of National Education appointed a Committee to investigate the training, use and status of Engineering Technicians in the Republic of South Africa.

The report of this Committee was submitted to the Minister in February, 1978 and its recommendations are likely to assist materially in clarifying the role of the technologist and technician in the engineering team alongside the professional engineer and improve their education and training.

The Committee recommends the name Engineering Technician for a person educated above NTC 3 standard doing work at a level above that of the artisan or operator while the term Technologist should be reserved for the holder of the proposed Diploma in Technology, who would operate in a broader field, having a greater depth of knowledge and being more intellectual in his approach. It also recommends that employers should use technicians and technologists where the scope and nature of the work permits. This could release professional engineers for work more appropriate to their qualifications and training.

Local Authorities employ large numbers of semi-professionally qualified staff and experience great difficulty in recruiting and retaining staff in this category. If implementation of the Committee's proposals assists in the relief of this difficulty we will be grateful indeed.

The report envisages that Colleges for Advanced Technical Education (CATE) which have since been redesignated Technicons, will be seen as institutions parallel to universities in the field of technical education, awarding diplomas based on internal examinations and validated by a national Council for Technological Awards. It proposes a separation into two streams of tertiary technical education outside the university, namely the N-stream awards issued by the Department of National Education and the T-stream awards issued by the Technicons. This would seem to make it more difficult for the bright apprentice to progress to diploma level as has been possible in the past, which is unfortunate. However the simultaneous re-introduction of the N4 and N5 and a new N6 level of national certificate will provide for him an avenue of advancement and the report recommends that transfer courses be arranged by the Technicons for students who may wish to transfer from the N to the T stream. Such a transfer will, in my opinion, not be an easy one and every endeavour should be made to channel students who have the necessary educational background and ability in mathematics and science to follow the T stream from the outset. The relevance of the possession of an adequate senior certificate symbol in these two subjects to success in the National Diploma for Technicians has been analysed in respect of Learner Technical Assistants in the Durban Electricity Department over the past ten years, as given in table I. It will be seen that a person with less than a D symbol at the higher grade has little hope of success.

Table I

Learner Technical Assistants since 1971 (excluding current LTAs)

AMEU CONVENTION MAY 1981

sal word om van hierdie metode van personeelwerwing gebruik te maak. In Durban is daar in die verlede maar min sukses behaal in hierdie rigting en dit is duidelik dat salarisse en diensvoorwaardes van 'n aansienlike hoër aard as dié in die buiteland moet wees alvorens daar enigins op internasionale vlak meedinging om personeel kan geskied. Indien munisipaliteite inderdaad daarin sou slaag om ingenieurs en tegnici in die buiteland te werf, sal hulle hierdie persone alleenlik kan behou as die salarisse wat aangebied word met dié van plaaslike industrieë vergelyk kan word.

### 3. DIE VERSLAG VAN DIE GOODE-KOMITEE

Na aanleiding van 'n besluit wat geneem is tydens die sesde kongres van die Federasie van Verenigings van Professionele Ingenieurs (FVPI) insake die onderrig en opleiding van ingenieurs, gehou in Augustus 1973, het die Minister van Nasionale Opvoeding 'n komitee aangestel om ondersoek in te stel na die opleiding, benutting en status van ingenieurs-tegnici in die Republiek van Suid-Afrika.

Die verslag van hierdie komitee is in Februarie 1978 aan die Minister voorgelê en die aanbevelings daarin vervat sal waarskynlik grootliks daartoe bydra om die rol van die tegnoloog en tegnikus naas die professionele ingenieur in die ingenieurspan te definieer en om hul onderrig en opleiding te verbeter.

Die komitee het aanbeveel dat die benaming ingenieurs-tegnikus, toegesê word aan 'n persoon wat hoër onderrig as NTS 3 ontvang het en wat meer gevorderde werk verrig as die ambagsman of operateur terwyl die benaming tegnoloog slegs toegesê word aan 'n persoon wat in besit is van die voorgestelde Diploma in Tegnologie, wie se werksterrein 'n groter veld dek, wat beskik oor groter kennis en meer intellektueel is in sy benadering. Daar is ook aanbeveel dat werkgewers gebruik moet maak van die dienste van tegnici en tegnolêë indien die bestek en aard van die werk dit toelaat. Sodoende sal professionele ingenieurs in staat gestel word om werk te verrig waarvoor hulle eintlik gekwalifiseer en opgelei is.

Plaaslike owerhede neem groot getalle half-professionele opgeleide persone in diens en vind dit moeilik om sodanige persone te werf en in hul diens te behou. Ons sal baie dankbaar wees indien die komitee se voorstelle hierdie probleem sou help oplos.

In die verslag word daar in die vooruitsig gestel dat Kolleges vir Gevorderde Tegniese Onderrig (KGTG), wat sedertdien die nuwe benaming van Technicons gekry het, gesien sal word as inrigtings wat onderrig verskaf parallel aan dié van universiteite en wel zover dit die gebied van tegniese onderrig aangaan, waar interne eksamens afgelê word vir die verwerving van diplomas wat geldig verklaar is deur 'n Nasionale Raad vir Tegnologiese Toekennings. Daar is voorgestel dat tersiêre tegniese onderrig, anders as dié verskaf deur universiteite, in twee bane verdeel word: 'n N-baan en 'n T-baan. Die toekennings van die N-baan word gedoen deur die Department van Nasionale Onderrig en dié van die T-baan deur die Technicons. Dit wil voorkom of dit dan vir die skander vakleerling moeiliker sal wees om 'n diploma te behaal as in die verlede en dit is baie jammer. Die herinstel van die Nasionalesertifikaatkursusse N4 en N5 en die instel van die nuwe Nasionalesertifikaatkursus N6, sal egter die moontlikheid skep vir meer gevorderde opleiding en in die verslag word aanbeveel dat oorgangskursusse deur Technicons gereël word vir studente wat van die N-baan na die T-baan wil oorgaan. Na my mening sal so 'n oorskakeling nie maklik wees nie en moet daar gepep word om studente wat oor die nodige opvoedkundige agtergrond en bekwaamheid in wiskunde en wetenskap beskik om 'n T-baankursus te loop, reeds uit die staanspoor uit te sonder. Hoe belangrik dit is dat kandidate vir die Nasionalediplomakursus vir Tegnici 'n toereikende matrieksimbool in die twee vakke moes behaal het, blyk uit die ontleding wat gedoen is van die vordering van leerling-tegniese assistente van die Durbanse Elektriese departement gedurende die afgelope tien jaar. Die resultate word verstrek in tabel I. Daar sal opgemerk word dat 'n persoon wat 'n simbool laer as 'n D behaal het in die hoër graad, 'n geringe kans staan om te slaag.

Tabel I

Leerling-tegniese assistente sedert 1971 (buiten huidige LTAs)

Note: All standard grade passes converted to higher grade for this analysis, e.g.  
 D standard grade = E higher grade,  
 E standard grade = F higher grade( etc.

	A	B	C	D	E	F
<b>Mathematics: Higher Grade</b>						
11 successful	---	---	---	---	---	---
16 unsuccessful	---	---	---	---	---	---
<b>Science: Higher Grade</b>						
11 successful	---	---	---	---	---	---
16 unsuccessful	---	---	---	---	---	---
<b>Aggregate: Higher Grade</b>						
11 successful	---	---	---	---	---	---
16 unsuccessful	---	---	---	---	---	---

The Goede Committee recommend the award of a national diploma (ND) after three years of a restructured course, comprising three semesters at College with the balance as in-service training, while a further 6 subjects at T4 level and the necessary in-service training would satisfy the requirements of the Higher National Diploma (HND). This will be the entrance qualification for the Diploma in Technology requiring further study a T5 and T6 level or could lead to the Certificate of Competency by passing Legal Knowledge and any further subjects required by the Commission of Examiners. An Advanced National Certificate (ANC) is also envisaged entailing the study of a limited number of subjects after HND with a corresponding depth of subject study.

As regards registration it is recommended that there be two categories namely:

- Professional Engineering Technologist — Pr. Tech. and Registered Engineering Technician — R. Tech.
- the former catering for holders of the Dip. Tech. and the latter for those with the ND or diploma technicians.

The subject of registration of technicians and technologists is by no means straightforward and is currently receiving consideration by an interim committee appointed after the promulgation of the enabling legislation, in the form of the Professional Engineers Amendment: Act No. 77/1979. The multiplicity of National Certificates and Diplomas existing and proposed will complicate the fixing of the academic standard for registration and the definition of the work reserved for the various categories of registered persons will be even more difficult than in the case of the professional engineer. The employer too has much difficulty in understanding and equating the many existing and proposed qualifications and the sooner the whole matter of semi-professional engineering qualifications and registration can be clarified or finalised the better it will be for industry and the academic institutions.

#### 4. THE FINNISTON REPORT ON THE ENGINEERING PROFESSION IN THE UNITED KINGDOM

In the light of the concern being felt in many quarters over the shortage of Engineers in South Africa, it is of interest to examine the situation in Britain as revealed by the Finniston Committee of Enquiry into the Engineering Profession, in a recent report to the British Government. The report makes recommendations regarding the registration of Engineers and Technicians, the structure of the profession, education and training and the enhancement of the status of the Engineer.

The enquiry initiated in 1977, stemmed from concern over the decline of Britain's manufacturing industry and its failure to compete effectively with other countries. The report identified engineering excellence as an essential to competitiveness as well as being central to coping with technical and market developments. It stressed the need for closer ties between industry and educational institutions to ensure that industry gets the engineers it requires, trained with

L.W.: Vir die doeleindes van hierdie ontleding word standaardgraadslagsyfers aangegee as hoërgraadslagsyfers, bv. D-syfer, standaardgraad = E-syfer, hoër graad; E-syfer, standaardgraad = F-syfer, hoër graad, ens.

	A	B	C	D	E	F
<b>Wiskunde: hoër graad</b>						
11 geslaag	---	---	---	---	---	---
16 nie geslaag	---	---	---	---	---	---
<b>Wetenskap: hoër graad</b>						
11 geslaag	---	---	---	---	---	---
16 nie geslaag	---	---	---	---	---	---
<b>Gemiddeld: hoër graad</b>						
11 geslaag	---	---	---	---	---	---
16 nie geslaag	---	---	---	---	---	---

Die Goede-komitee he taanbevel dat 'n Nasionale Diploma (ND) tegeken word by die suksesvolle voltooiing van 'n nuut saamgestelde kursus van drie jaar. Vir drie semesters word klasse aan 'n kollege geloop terwyl die studente gedurende die oorblywende tyd indiensopleiding ondergaan. Indien 'n verdere ses vakke op T4-vlak geslaag en die nodige bykomende indiensopleiding ondergaan word, word die Hoër Nasionale Diploma (HND) tegeken. Hierdie kwalifikasie moet behaal word om te kan inskryf vir die Diploma in Tegnologie waarvoor T5- en T6-studies onderneem moet word. So nie kan 'n persoon wat die HND verwerf het, by die slaag van Regskennis en enige ander vakke wat deur die Kommissie van Eksaminators voorgeskryf word, 'n Bevoegdheidsertifikaat verwerf. Daar word ook beoog om 'n gevorderdenasionale sertifikaat-kursus in te stel wat die bestudering van 'n beperkte aantal vakke (na verwerwing van die HND) asook 'n diepgaande studie van sodanige vakke behels.

Betreffende registrasie word daar aanbeveel dat twee kategorieë onderskei word, naamlik —

- Professionele Ingenieurstechnoloog — Pr. Teg.; en
  - Geregistreerde Ingenieurstechnikus — G. Teg.
- Eersgenoemde moet beskik oor 'n Diploma in Tegnologie en laasgenoemde oor die Nasionale Diploma of hy moet 'n gekwalifiseerde tegnikus wees.

Die kwessie van die registrasie van tegnisi en tegnoloe is volstrek nie 'n eenvoudige saak nie en word tans oorweeg deur 'n tussentydse komitee wat aangestel is nadat die magtigingswetgewing, naamlik die Wysigingswet op Professionele Ingenieurs, nr. 77 van 1979, afgekondig is. Die veelvuldigheid van die nasionale sertifikate en diplomas — bestaande sowel as voorgestelde — sal die taak om die akademiese standaard vir registrasie te bepaal, bemoeilik. Die afbakening van die werkgebied van elkeen van die onderskeie kategorieë geregistreerde persone sal nog moeiliker wees as in die geval van professionele ingenieurs. Ook die werkgever vind dit uiters moeilik om die talje bestaande en voorgestelde kwalifikasies te onderskei en te vergelyk en hoe gouer die aangeleentheid betreffende half-professionele-ingenieurskwalifikasies en registrasie uitgepluis en afgehandel kan word, hoe beter vir die nywerheid en die akademiese inrigtings.

#### 4. DIE FINNISTONVERSLAG AANGAANDE DIE INGENIEURSBEROEP IN DIE VERENIGDE KONINKRYK

Vanweë die feit dat daar kommer bestaan oor die tekort aan ingenieurs in Suid-Afrika is dit nuttig om te kyk na die situasie in Brittanje soos beskryf in die verslag van die Finniston-kommissie van ondersoek na die ingenieursberoep wat onlangs aan die Britse regering voorgelê is. In die verslag word aanbevelings gedoen betreffende registrasie van ingenieurs en tegnisi, die struktuur van die beroep, onderrig, opleiding en die verhoging van die status van die ingenieur.

Die ondersoek wat in 1977 gelas is, het voortgespruit uit die agteruitgang in Brittanje se fabrieksnwyerheid en die feit dat die nywerheid nie daarin kon slaag om met dié van ander lande mee te ding nie. Die verslag het daarop gewys dat voortreflike ingenieurswee 'n voorvereiste is vir konkurrensie en noodsaaklik is indien treg gehou wil word met ontwikkelings op tegniese en handelsgebied. Klem is gelê op die behoefte aan nouer samewerking tussen die nywerheid en opvoedkun-

industrial practice in mind and possessing creativeness and a capacity for-innovation.

There is a need to encourage the study of mathematics and physics to a high level at school and the best students should be attracted to the Engineering Profession. A key determinant of career choice, according to the report, was relative material reward and industry should re-appraise the contribution of its engineers and introduce regular engineer-manpower audits.

The Committee identifies three types of engineers, each of which should be registered as follows:—

- (a) Registered Engineer (Diplomate). These would be the leaders in innovation and policy making and would do a 4 year M. Eng. Course plus 2 years training (= 6 years total).
- (b) Registered Engineer — the main body of competent engineering managers and innovators. They would do a 3-3½ years B. Eng. course, plus 2-2½ years training (= 5½ years total), alternatively a 4 year B. Eng. sandwich course plus 1½ years training (= 5½ years total).
- (c) Registered Engineer (Associate) — the technicians, who would take a 2 year TEC, plus 3 years structured experience (= 5 years total) or 3 years HED sandwich, plus 2 years structured experience (= 5 years total).

These three tiers of engineers are seen to be the equivalent of our Professional Engineer and possible future Registered Technologists and Registered Technician respectively.

A statutory body, the Engineering Authority, founded by Government is proposed to control the registration of engineers and the accreditation of courses. This body would be similar to the South African Council for Professional Engineers plus Boards of Control, but its function would be somewhat wider to include the establishment of academic curricula and methods of engineering education; it will also have the function of co-ordinating research and development to aid industry and to act as a lobby group for the engineering profession with Government.

In regard to licensing or the reservation of engineering work for registered persons the Committee was of the view that the diversity of engineering militated against this and that registration should become in effect a licence once employers demand that their engineers be registered. Two activities did however in the opinion of the Committee, merit formal licensing: those which involved public hazard, or consultancy. The proposals of the Committee concerning licensing are likely to prove contentious and it is interesting to note the observations of Dr. George Gainsborough, former Secretary of the Institution of Electrical Engineers, on the subject. He describes the proposals as "timid" and comes out strongly in favour of licensing, pointing out that if the withholding or withdrawing of registration were to have no significant effect on an engineer's prospects why should he bother and why should a university bother whether its degree courses were accredited or not. He states that the best way of attracting the best young people into the engineering profession is to make it one which is manifestly well educated, well trained and well disciplined, to which work of great social importance has been entrusted. "That means licensing engineers", he concluded.

## 5. THE PROFESSIONAL ENGINEERS ACT

The Professional Engineers Amendment Act No. 77/1979 introduced a new Section 21 (1A) which made provision, inter alia, for the Act to be applicable to local authorities, whereas

dige inrigtings ten einde te verseker dat die soort ingenieur wat die nywerheid verlang, opgelewer word; 'n ingenieur opgelei met inagneming van die nywerheidspraktyk en wat beskik oor skeppende vermoëns en vindingrykheid.

Die neem van Wiskunde en Wetenskap as vakkos in die hoër standers moet aangemoedig word en onder die beste leerlinge moet belangstelling in die ingenieursberoep gewek word. Volgens die veralg is materiële vergoeding van deurslaggewende belang by die keuse van 'n beroep en die nywerheid moet die rol van ingenieurs in die bedryf weer in oënskou neem en gereelde ingenieursmannekragsoutdite instel.

Die Komitee onderskei drie tipes ingenieurs wat geregistreer word as —

- (a) Geregistreerde ingenieur (Diploma): Hulle sal leiding neem op die gebied van nuwe ontwikkelings en beleidsformulering en volg 'n vierjaarkursus vir die M. Ing.-graad gevolg deur twee jaar opleiding ('n totaal van ses jaar).
- (b) Geregistreerde ingenieur: Die grootste gros bevoegde rigtinggewende ingenieurs en invoerders van nuwegeide in die ingenieursberoep. 'n B. Ing.-graadkursus van 3 tot 3½ jaar word afgelei gevolg deur 2 tot 2½ jaar opleiding ('n totaal van 5½ jaar) of andersins 'n B. Ing.-stapelkursus gevolg deur 1½ jaar opleiding ('n totaal van 5½ jaar).
- (c) Geregistreerde ingenieur (Assosiaat): Die tegnisi wat 'n tweejaarkursus aan 'n TOK loop en daarna 3 jaar lank ondervinding volgens 'n spesifieke werkprogram opdoen ('n totaal van 5 jaar) of andersins 'n driejaar-stapelkursus loop en daarna 2 jaar lank ondervinding volgens 'n spesifieke werkprogram opdoen ('n totaal van 5 jaar).

Die onderskeid tussen hierdie drie tipes ingenieurs kan beskou word as soortgelyk aan die onderskeid wat daar moontlik in die toekoms hier getref sal word tussen 'n professionele ingenieur, 'n geregistreerde tegnoloog en 'n geregistreerde tegnikus.

Daar is voorgestel dat 'n ingenieursowerheid wat deur die regering daargestel moet word, beheer moet uitoefen oor die registrasie van ingenieurs en die akkreditering van kursusse. Hierdie liggaam sal soortgelyk wees aan die Suid-Afrikaanse Raad vir Professionele Ingenieurs en die onderskeie beheerrade, maar sal 'n groter aantal pligte opgelê word wat sal insluit die opstel van akademiese leerplanne en die bepaling van onderrigmetodes. Die voorgestelde owerheid sal ook navorsing en ontwikkeling moet koördineer en moet namens die ingenieursberoep as drukgroep optree by die regering.

Met betrekking tot lisensiering — te wete die voorbehou van ingenieurswerk vir geregistreerde persone — was die Komitee van mening dat die diversiteit van die ingenieursberoep die saak sou bemoeilik en dat registrasie op selfs as lisensie moes dien indien werkgewers daarop sou begin aandring dat hul ingenieurs geregistreer moet wees. Die Komitee was egter van mening dat daar wel lisensies uitgereik moes word ten opsigte van twee soorte bedrywe, naamlik dié wat gevaar vir die publiek kon inhou en raadsagende dienste. Die voorstelle van die Komitee sal waarskynlik verskillende menings uitlok en dit is interessant om te let op die opmerkings van dr. George Gainsborough, voormalige Sekretaris van die Instituut van Elektrotegniese Ingenieurs, in die verband. Hy het die voorstelle as baie "bedoes" beskryf en het hom sterk ten gunste van lisensiering uitgespreek. Hy het verder daar op gewys dat indien die terughoofding of terugtrekking van 'n ingenieur se registrasie geen uitwerking op sy werksvooruitsigte het nie, daar geen rede is waarom hy of uwerseite sal omgee of graadkursusse geakkrediteer is of nie. Hy het beweer dat die beste manier om die knapste jong mense in die beroep te laat belangstel, is om die deeglike onderrig, opleiding en dissipline daar te stel en die beroep te verhef tot een waarvan groot sosiale waarde geheb word. "Dit beteken dat ingenieurs gelisensieer moet word" het hy afgesluit.

## 5. DIE WET OP PROFESSIONELE INGENIEURS

Die Wysigingswet op Professionele Ingenieurs, Wet nr. 77/1979 het 'n nuwe artikel — artikel 21 (1A) — ingevoeg waarvan daar onder andere bepaal word dat die Wet ook op plaas-

previously its scope was confined to the activities of Consulting Engineers only.

Government Notice No. R.683 published in Government Gazette No. 6928 on 3 April 1980 sets out the conditions under which it is proposed to exempt local authorities from the provisions of Section 21 (1A) of the Act. In terms of this Notice, local authorities will be exempt: provided that "not later than five years from the date on which Section 21 (1A) of the Act comes into operation such local authority or institution shall arrange for work reserved for professional engineers in terms of Section 7(3)(c) of the Act to be performed by, or under the direction or control of a professional engineer."

In considering the implications of this legislation on local authorities concerned with the supply of electricity, two questions arise:

- (1) What is meant by "under the direction or control of a professional engineer"?
- (2) What is the extent of "work reserved for professional engineers" in relation to the activities of municipal electricity supply authorities?

Dealing with the first question, it could be suggested that the legal requirement would be met if only the official in charge of the organisation, i.e. the Town Electrical Engineer is a professional engineer. This proposition has been examined by the Legal Adviser to the Durban City Council. He is of the opinion that this would depend on the extent to which the official in charge is in a position to exercise personal "direction or control" (in the true management sense) over all work of the type reserved for professional engineers. To the extent to which he is unable to exercise such personal "direction or control" he should delegate responsibility and authority to other professional engineers in respect of the said "direction or control". Thus it appears that, while a single appointment of a professional engineer may satisfy the requirements in a relatively small authority, large undertakings will require to employ a sufficient number of professional engineers to ensure that personal direction and control of "reserved" work is possible.

In respect of the second question just what is included in "work reserved for professional engineering"?

According to Government Notice No. R.3063 of 8 August 1969 the kinds of work concerned are those:

- (a) which involve investigating, advising, reporting, evaluating, measuring, planning, designing, specifying, laying out, directing, constructing, commissioning, inspecting or testing of a degree or standard requiring the skilled application of the principle of mathematics, the basic physical sciences . . . and the basic engineering sciences . . . for their development and attainment; and
- (b) in respect of which the knowledge of the principles aforesaid can only be acquired by having followed the curriculum which is from time to time determined for one or other of the examinations prescribed in terms of Section 19 or recognised in terms of Sections 18(2)(b) or 18(6)(c)(ii) of the Act and having passed such examination . . ."

This definition is perhaps deliberately or unavoidably imprecise and opinions are likely to differ widely as to what work undertaken by a local authority constitutes work reserved for professional engineers. However there is, in my opinion, little likelihood that the work of a Town Electrical Engineer for example, which is presently being successfully executed by a non-professional engineer, could suddenly be classified as work reserved for professional engineers, as it will be obvious that the knowledge required could be acquired by means other than having followed the curriculum prescribed for qualifications recognised for registration as a professional engineer. It is unlikely therefore that those engineers in charge of undertakings who are not registered as professional engineers need fear being rendered jobless in five years time but, at the same time it should be recognised that with growth in size and complexity of distribution

like overhede van toepassing is terwyl dit voorheen slegs op raadgevende ingenieurs betrekking gehad het.

Die voorwaardes waaronder plaaslike owerhede van die bepalings van artikel 21(1A) van die Wet vrygestel word, is uiteengesit in Goewermentskennisgewing nr. R.683 wat gepubliseer is in Staatskoerantnr. 6928 van 3 April 1980. Kragtens hierdie kennisgewing sal plaaslike owerhede vrygestel word mits "sodanige plaaslike bestuur of instelling nie later nie as vyf jaar vanaf die datum van inwerkingtreding van artikel 21(1A) van die Wet, reëlings tref dat werk wat kragtens artikel 7(3)(c) van die Wet vir professionele ingenieurs gereserveer is, deur of onder die leiding of beheer van 'n professionele ingenieur verrig word".

By die oorweging van die implikasies van hierdie wetgewing vir plaaslike owerhede gemeed met elektrisiteitsvoorsiening, duik twee vrae op:—

- (1) Wat word bedoel met "onder die leiding of beheer van 'n professionele ingenieur"?
- (2) Wat is die omvang van die "werk wat vir professionele ingenieurs gereserveer is" in verhouding tot die bedrywigehede van munisipale elektrisiteitsvoorsieningsowerhede?

Betreffende die eerste vraag kan daar aangevoer word dat daar aan die vereistes van die Wet voldoen sal word indien slegs die beaamte in beheer van die organisasie, bv. die stads-elektrotegniese ingenieur, 'n professionele ingenieur is. Hierdie stelling is ondersoek deur die Regsdireur van die Durbanse Stadsraad. Hy is van mening dat dit sal afhang van die mate waarin die betrokke beaamte in beheer werklik persoonlike "leiding of beheer" (in die ware sin van die woord) oor al die werk wat vir professionele ingenieurs gereserveer is, kan uitoefen. In sverre hy nie sodanige persoonlike leiding kan gee of beheer kan uitoefen nie, moet hy die verantwoordelijkheid en bevoegdheid aan ander professionele ingenieurs deleger met betrekking tot genoemde "leiding en beheer". Dit wil dus voorkom of dit wel vir relatief klein plaaslike owerhede voldoende sal wees om slegs een professionele ingenieur aan te stel, maar groter plaaslike owerhede sal 'n voldoende aantal professionele ingenieurs moet aanstel om persoonlike leiding en beheer in die geval van "gereserveerde" werk moontlik te maak.

Betreffende die tweede vraag wonder 'n mens wat bedoel word met "werk wat vir professionele ingenieurs gereserveer is"?

Volgens Goewermentskennisgewing nr. R.3062 van 8 Augustus 1969 sluit dit in werk —

- (a) wat te doen het met ondersoek, raadgeving, veralgemening, evaluering, opmeting, beplanning, ontwerp, spesifisering, uitleg, bestuur, konstruksie, ingebruikneming, inspeksie of toetsing van 'n graad of standaard wat die vaardige aanwending van die beginsels van wiskunde, die basiese natuurwetenskappe . . . vir hul ontwikkeling en bereiking verg; en
- (b) ten opsigte waarvan kennis van voormelde beginsels slegs opgedoen kan word deur die leergraag wat van tyd tot tyd nageleë word vir een of ander van die eksamens voorgeskryf kragtens artikel 19 of erken kragtens artikels 18(2)(b) of 18(6)(c)(ii) van die Wet te geveg het en in sodanige eksamen te geslaag het . . ."

Hierdie definisie is miskien doelbewus of onvermydelik vaag en daar sal heel waarskynlik groot meningsverskille bestaan oor watter van die werk wat deur plaaslike owerhede onderneem word, vir professionele ingenieurs gereserveer moet word. Na my mening is dit nie baie waarskynlik dat die werkvan 'n stads-elektrotegniese ingenieur, wat tans heeltemal bevreëdigend deur nie-professionele ingenieurs behartig word, skielik vir professionele ingenieurs gereserveer sal word nie, aangesien dit duidelik is dat die nodige kennis opgedoen kan word op ander wyses as deur die volg van die curriculum voorgeskryf vir die behaal van die kwalifikasies wat vereis word vir registrasie as professionele ingenieur. Dit is dus onwaarskynlik dat daardie ingenieurs wat aan die hoof staan van ondernemings en nie as professionele ingenieurs geregistreer is nie, oor sowat vyf jaar hul betrekkinge sal verloor, maar daar moet terselfdertyd in ag geneem word

networks and of electrical technology, greater stress will in future be placed on the possession of appropriate professional qualifications.

## 6. THE FACTORIES ACT

Engineers in charge of municipal electricity supply undertakings are probably all too aware of their responsibilities under the Factories Act and may find difficulty in seeing this as an "ally", rather than an avowed "enemy". Yet this is the appeal made by our good friend the Chief Inspector of Factories, Mr. Gus Weich, in an article which appeared in the publication "Safety Management" in August, 1978.

The article under the title "The Factories Machinery and Building Work Act, 1941, as a tool of management" indicates that the Factories Act "makes it possible for any organisation to function along normal business lines and does not require a different managerial structure for discharging the legal obligations from that which is set up for all other purposes".

Regulation C.1(3) makes provision for the appointment of "Subordinate Competent Persons" to assist the person appointed in overall charge of all machinery, thereby permitting the delegation of responsibility under the Act in harmony with the delegation of duties and functions within the organisation. Persons appointed in terms of this regulation carry the same responsibility as the "Responsible" person in respect of their particular functions and within their areas of jurisdiction.

In examining the existing appointments under the Factories Act in the Durban Electricity Department recently it was readily apparent that insufficient cognisance had been taken of the provisions of Regulation C.1(3) in that too few appointments of Subordinate Competent Persons had been made, considering the size of the Department and the physical area of the "Factory" premises, some 1 480 km<sup>2</sup>. The organisational structure of the Department provided for effective delegation of management functions through various branches, divisions and sections and the duties of posts at different levels were reasonably well defined and understood. In practice the responsibility for the detailed and direct personal supervision of work and the operation and maintenance of machinery had been properly passed down to junior management staff who were in the best position of authority, knowledge and experience to ensure that the provisions of the regulations were satisfied. However, the appointments made in terms of the Factories Act of these junior managers were quite inappropriate, being in terms of Regulation C.7(2). Regulation C.7(2) merely requires the appointee to report in writing any defect in machinery or dangerous situation.

In other words he acts as "eyes and ears" for the appointed Responsible Person whereas a C.1(3) appointee is expected to get something done about unsafe conditions. It was obvious that the junior managers should be C.1(3) and not C.7(2) appointees.

Considerable opposition was expressed by the staff concerned towards the change in appointment from C.7(2) to C.1(3), which was seen as the imposition upon them of additional responsibilities. There can be no doubt that an appointment in terms of Regulation C.1(3) is far more onerous than a C.7(2) appointment. Responsibility in terms of the Factories Act is, however, governed by Section 40 of the Act. This covers the liability of managers and agents and employees alike and under the provisions of this section all employees, whether or not they carry an appointment under the Regulations, have a legal responsibility for the consequences of their acts or omissions in relation to their particular functions and responsibilities. In the case of the junior managers the appointment in terms of Regulation C.1(3) did not increase the degree of their responsibility for the safe installation, maintenance and operation of machinery, etc., in their particular sections, but it certainly did make them more conscious of those responsibilities.

dat daar vanweë die toename in grootte en kompleksiteit van distribusienette en vooruitgang op tegnologiese gebied, in die toekoms strengere vereistes gestel sal word met betrekking tot die besit van die toepaslike professionele kwalifikasies.

## 6. DIE WET OP FABRIEKE, MASJINERIE EN BOUWERK

Ingenieurs aan die hoof van munisipale elektrisiteitsvoorsieningsondernemings is maar al te bewus van die verantwoordelikhede wat hulle opgelê is kragtens die Wet op Fabriek en sal dit moontlik moeilik vind om dit te sien as 'n bondgenoot eerder as 'n geswore vyand. Dit is egter die beroep wat op sodanige ingenieurs gedoen word deur die Hoofinspekteur van fabriek, mnr. Gus Weich, in 'n artikel wat in Augustus 1978 in die publikasie "Safety Management" verskyn het.

In die artikel, getitel "The Factories, Machinery and Building Work Act, 1941, as a tool of management" is vermeld dat die Wet op Fabriek "dit moontlik maak vir enige organisasie om soos 'n normale sakeonderneming bedryf te word en die bestuurstruuktuur vereis vir die uitvoer van die pligte ingevolge die Wet opgelê, verskil nie van die bestuurstruuktuur wat vir alle ander doeleindes daargestel word nie."

In regulasie C.1(3) word daar voorsiening gemaak vir die aanstelling van "ondergeskikte bevoegde persone" om die persoon by te staan wat in bevel is van al die masjinerie. Derhalwe kan die pligte wat ingevolge die Wet opgelê word, net soos in die geval van ander pligte binne die organisasie, gedeelgeer word. Persone wat ingevolge hierdie regulasie aangestel word, dra dieselfde verantwoordelikhede as die "verantwoordelike" persoon sover dit die vervulling van hul besondere pligte binne hul reggebiede aangaan.

By 'n ondersoek wat gedoen is na die aanstellings wat ingevolge die Wet op Fabriek in die Durbanse Stads elektrisiteitsdepartement gedoen is, het dit geblek dat daar nie voldoende ag geslaan is op die bepalings van regulasie C.1(3) nie, aangesien hooploos te min persone as ondergeskikte bevoegde persone aangestel is; die grootte van die Departement en dieselfde oppervlak van die "fabriekpersele" (nagenoeg 1 480 km<sup>2</sup>) in ag geneem. In die organisatoriese struuktuur van die Departement is daar voorsiening gemaak vir die doeltreffende delegering van pligte in die verskeie takke en afdelings en die pligte verbonde aan die poste op verskillende vlakke was redelik goed gedefinieer en begryp. In die praktyk is die verantwoordelikhede vir spesifieke en direkte toetsing oor werk en die bedien en instandhouding van masjinerie soos dit hoort opgedra aan junior bestuurspersonele wat oor die bevoegdheid en die beste kennis en ondervinding beskik om te verseker dat daar voldoen word aan die bepalings van die regulasies. Die aanstelling van hierdie junior bestuurders kragtens die Wet op Fabriek is egter nie ooreenkomstig die toepaslike regulasie gedoen nie, maar wel ooreenkomstig regulasie C.7(2). Hierdie regulasie bepaal slegs dat die aldus aangestelde persoon enige defekte masjinerie of gevaarlike toestande skriftelik moet aanmeld. Hy dien dus slegs as "oë en ore" van die verantwoordelike persoon, terwyl 'n persoon wat ooreenkomstig regulasie C.1(3) aangestel is, daadwerklik moet optree in verband met onveilige toestande. Dit is dus duidelik dat die junior bestuurders ooreenkomstig regulasie C.1(3) en nie regulasie C.7(2) aangestel moes gewees het nie.

Talle besware is deur die betrokke personelede geopper teen 'n verandering van 'n aanstelling kragtens regulasie C.7(2) na 'n aanstelling kragtens regulasie C.1(3), aangesien hulle van mening was dat hulle daardeur addisionele pligte opgelê is. Dit is ongetwyfeld so dat 'n aanstelling kragtens regulasie C.1(3) meer beswarend is. Bepalings aangaande verantwoordelikhede ingevolge die Wet op Fabriek verskyn in artikel 40 van die Wet. Hierdie artikel het betrekking op die aanspreeklikheid van bestuurders, agente en werknemers en ooreenkomstig die bepalings van hierdie artikel is alle werknemers, hetsy aangestel kragtens die regulasies al dan nie, regens aanspreeklik vir die gevolge van hulle dade of verantwoordelikhede. In die geval van junior bestuurders het die aanstelling kragtens regulasie C.1(3) nie groter verantwoordelikhede ten opsigte van die veilige installering, instandhouding en bedien van masjinerie, ensowatens in hulle besondere afdelings meegebring nie, maar dit het hulle beslis meer bewus van hulle verantwoordelikhede gemaak.

There is a further benefit in a review of appointments in an organisation in terms of Regulation C.1(3) in that it forces management to take a very close look at precise divisions of responsibility, in order to clearly define these in the letters of appointment. This is not always a simple matter, particularly in the case of a municipal electricity supply undertaking whose activities are often widespread and intimately involved with those of other municipal departments. The review conducted in the Durban Electricity Department has increased the number of C.1(3) appointments under two "Responsible Persons" from 2 to 58. This numerical change in appointments is probably a fair reflection of the increased awareness of the implications of the Act among staff concerned and from this aspect alone the exercise has been worthwhile.

In justification of his claim that the Act is an "ally" rather than an "enemy" Mr. Weich, in the article to which I referred earlier, says "There is no doubt that the Act can strengthen the manager's position considerably. It could assist him in obtaining assistance from the owners in the form of money, facilities and in some cases skilled people, and it could be a help to him in maintaining discipline in the ranks below him."

#### 7. ELECTRIFICATION OF BLACK TOWNSHIPS

In his Presidential Address in 1977, Mr. K. G. Robson referred with regret to the omission of the provision of electricity in new houses constructed by the Government in Black townships. It is apparent that the demand for housing outstrips the funds available for the development of the townships and the building of houses and that domestic electricity is seen as an optional extra which can be omitted in favour of providing more basic dwelling units. While this decision in priority is understandable it cannot, in my view, be regarded as reasonable to ignore the essentiality of electricity in the home in the era in which we live. Sooner or later the problem must be faced and the longer it is left the costlier it becomes to provide the reticulation and wire the houses. It is obvious that the service should be provided from the outset and ways and means should be found to provide the capital required. There appears to be no reason why the provision of electricity to Black houses should not be on an economic basis, as many surveys have shown that the average household spends as much on alternative fuels, candles and batteries as it would on electricity.

As recorded earlier in this address the electrification of Soweto is now in progress. Of prime importance will be the training of staff and the setting up of an organisation to handle the subsequent operation and maintenance of the undertaking, a task which would have been much easier had the installation of electricity gone hand in hand with the construction of the township over a much longer period. It is possible that advice and assistance from members of the AMEU in regard to this problem will be welcomed and I have no doubt that this will be readily offered.

#### 8. CONCLUSION

The curtailment of our Conventions to three days necessitates the careful planning of our time. Factory visits have had to be sacrificed and the traditional free evening has disappeared. Nevertheless during these three days there will be opportunities for much valuable formal and informal exchange of information and viewpoints. In this unique association of commercial and municipal interests which constitutes the AMEU, we have a foundation on which to build a structure capable of assisting in meeting the challenge of our times in our own field of endeavour. Let us take advantage of the presence with us of colleagues from other disciplines, which in one way or another impinge on our own, to indulge in dialogue on a broad basis and make this 47th Biennial Convention memorable in all respects.

'n Verdere voordeel wat 'n hersiening van aanstellings in 'n organisasie kragtens regulasie C.1 inhou, is dat die bestuur dan gansoosmaak word om die presiese verdeling van verantwoordelikhede deeglik in oënskou te neem ten einde hierdie verantwoordelikhede duidelik te kan aanstip in die aanstellingsbriewe. Dit is nie altyd 'n maklike taak nie, veral in die geval van 'n munisipale elektrisiteitsvoorsieningsonderneming wie se taak 'n wye terrein dek en nou gemeed is met dié van ander munisipale departemente. As gevolg van die ondersoek wat in die Durbanse Elektrisiteitsdepartement gedoen is, is die aantal persone wat kragtens regulasie C.1(3) aangestel is onder twee verantwoordelike persone verhoog van 2 tot 8. Hierdie verandering is waarskynlik 'n goeie aanduiding van die toenemende bewuswording onder personelede van die implikasies van die Wet en dit alleen het genoemde ondersoek die moete werd gemaak.

Ter regverdiging van sy bewering dat die Wet 'n "bondgenoot" eerder as 'n "vyand" is, het mnr. Weich in die artikel waarna ek vroeër verwys het, gesê: "Dit ly geen twyfel nie dat die Wet die bestuurder se posisie aansienlik kan versterk. Dit kan hom help om hulp van die eienaars te kry by wyse van geld, fasiliteite en in sommige gevalle opgeleide mense en dit kan bydra tot die handhawing van dissipline onder ondergeskiktes."

#### 7. DIE ELEKTRIFIKASIE VAN SWART DORPE

In 1977 hetmnr. K. G. Robson in sy presidentarede sy spyt daaroor uitgespreek dat die staat versuim het om die nuwe huise wat in Swart dorpe opgerig word, van elektrisiteit te voorsien. Die aanvraag na behuising is natuurlik veel groter as wat die fondse beskikbaar vir die ontwikkeling van dorpe en die oprig van huise toelaat en elektrisiteit vir huishoudelike gebruik word beskou as 'n nie-noodsaaklike bykomstigheid was prys gegee kan word ter wille daarvan om meer basiese woon-eenhede op te rig. Ofskoon hierdie orde van prioriteit byrryplik is, is dit na my mening nie redelik om die noodsaaklikheid van elektrisiteit in die huis in die era waarin ons leef te ignoreer nie. Een of ander tyd sal die probleem in die gesig gestaar moet word en hoe langer daar getalm word, hoe duurder word dit om die elektrisiteitanet te voorsien en die huise te bedraad. Dit is duidelik dat hierdie diens uit die staanspoor reeds verskak moet word en wyses moet gevind word om die kapitaal daarvoor te bekom. Daar is skynbaar geen rede waarom die voorsiening van elektrisiteit aan Swart huisebwoners nie ekonomies kan wees nie, aangesien dit uit tallo opnames geblyk het dat die gemiddelde huishouding net soveel aan brandolies, kerse en batterye bestee as wat hulle aan elektrisiteit sou bestee.

Soos vroeër in hierdie rede vermeld is daar 'n aanvang geneem met die elektrifisering van Soweto. Van die grootste belang sal wees die opleiding van personeel en die daarstel van 'n organisasie om die dryf en instandhouding van die onderneming waar te neem; 'n taak wat baie makliker sou gewees het indien bedrading oor 'n langer tydvak hand aan hand gegaan het met die oprig van huise in die dorpe. Die raad en bystand van lede van die VMEQ in die verband sal moontlik verwelkom word en ek betwyfel dit nie dat hulp wel aangebied sal word.

#### 8. SLOTSOM

Vanweë die feit dat die duur van ons kongresse verkort is tot drie dae, moet die besteding van ons tyd versigtig beplan word. Besoek aan fabriekse moes prysgegee word en daar is weggedoen met die tradisionele vry aand. Daar sal niestem gedurende hierdie drie dae geleentheid wees vir die waardevolle uitruil van inligting en standpunte op formele en informele vlak. Hierdie unieke samesmelting van handels- en munisipale instansies waaruit die VMEQ saamgestel is, bied die grondslag vir die daarstel van 'n liggaam wat daartoe in staat is om daartoe die hoof te bied. Laat ons dan van hierdie geleentheid gebruik maak om met ons kollegas uit ander dissiplines, wat op die een of ander manier met ons eie gemeed is, te beraad en van hierdie 47ste tweejaarlike kongres 'n onvergeetlike gebeurtenis te maak.





Mr. D. H. Fraser.

#### MR. K. G. ROBSON: EAST LONDON

Mr. President, distinguished guests, ladies and gentlemen. I am happy to know that the roles are reversed this morning — four years ago at the Convention in East London you, Mr. President, honoured me by moving the vote of thanks for your Presidential Address. Your generous remarks on that occasion placed me in your debt and therefore at this 47th Convention I am especially privileged to be able to repay — in smaller measure — that debt.

How quickly and dramatically situations change. We have been reminded that four years ago South Africa was in a climate of economic depression with high oil prices and low gold prices. The price of gold soared in 1980 and today South Africa is booming economically and industrially. But what your address underscores is that in this four year period the inflation rate has rocketed and the supply position with regard to skilled manpower has deteriorated alarmingly.

It is in the specific area of skilled technical manpower that you Mr. President have an abiding interest and your sterling contribution as far as municipal electricity undertakings is concerned is deserving of our praise and appreciation. It is good that you have directed our attention to the implications of the Wiehahn and Rieckert Commission Reports and have rightly challenged local authorities to commit themselves to implementing the recommendations of the Commissions.

Mr. President your address has brought us up to date through the concise summarising of recent developments affecting the engineering profession in respect of the Goode Committee Report, the Finnistor Report in the United Kingdom and the Professional Engineers Act. Moreover, hopefully your opinion on the future of non-professional municipal electrical engineers will help to remove some of the disquiet and apprehension in the minds of a number of our members.

The Durban Electricity Undertaking must be commended on the positive steps taken in terms of Regulation C1, 3 of the Factories, Machinery and Building Work Act and this provides evidence of your personal commitment to high standards of safety and loss control management. Your message to all Undertakings to use the Act to good purpose has been spelt out clearly.

You have a daunting task Mr. President in guiding us through a full Agenda in three days. This opening session this morning has made heavy demands on you and it is to be regretted that in the deliberation of this Convention your Presidential Address cannot be given the consideration it merits because of time pressures. Most surely you will imprint your own engaging and respected personality on the whole of this Convention. Referring to the concluding statement in your address, I have no doubt that it will indeed be "memorable in all respects" because you will have made it so. The City Council of Durban this day will delight to bask in your reflected glory.

Madam Mayor, ladies and gentlemen it is my special honour and pleasure to propose, on your behalf, a formal yet warm vote of thanks to our President for his impressive address and to ask that it be accorded your acclamation.

#### MNR. J. K. VON AHLFTEN: SPRINGS

Ek beskou dit as 'n voorreg om die bedanking van die Presidentre te skondeer en die President daarmee te komplimenteer.

Met die deurblaai van die Presidentarede het enkele gedagtes by my opgekook wat my teruggevoer het na my eie Presidentarede tydens die 1971 Konvensie in Kaapstad.

Hier verwys ek spesifiek na die President se opmerking oor die salarisse wat aan munisipale werknemers aangebied word en die kunsmatige inkorting van die salarisse van hooggeplaaste amptenare as gevolg van die onrealistiese vaspenning van die salarisse van Stadskerke deur die Provinsiale Owerhede.

Reeds in 1971 is daar in 'n hoofartikel van die tydskrif "Munisipale en Openbare Dienste" daarop gewys dat terwyl daar getwis word hoeveel 'n Stadskerk betaal moet word, kosbare tyd en breinkrag verlore gaan wat so dringend noodsaaklik is om munisipale dienste doeltreffend te lewer.

Miskien is dit nou reeds te laat om hierdie kortstygende beleid te probeer verander en soos u terug daarop gewys het, Meneer die President, sal dit 'n groot mate van wysheid en geduld aasook durf vereis om die nuwe bedeling van werk en werkverhoudings wat vir munisipale elektrisiteitsvoorsiening in die volgende dekades in vooruitgesit gestel word te laat slaag. Mr. President, allow me briefly to refer to an article that appeared recently in an EASA News Bulletin with the appropriate title "The vultures descend or, where have all the engineers gone?" which gives the other side of the story namely, when one looks at the type of work graduates are performing one must wonder about the question of manpower utilisation.

Does one for example spend six years training as an electrical engineer to sell calculators and to install and maintain certain power installations? Does the official concerned really need to be a Professional Engineer despite what the Professional Engineers Act wishes to imply?

The sheer waste of engineering skills has become alarming — one hears from time to time the classic military answer to the question of why better use is not made of engineering graduates — "Engineers make good officers and we need officers more than we need the engineering profession at large."

Perhaps the answer to the question, where have all the engineers gone is "Alive and well, earning fortunes as salesmen, technicians, programmers . . . etc."

As you pointed out Mr. President, there are also many problems to be faced at the technician and artisan training level and only if the seriousness of these problems is realised will something be done. These are as fundamental as school education and it has certainly taken blood, sweat and tears to get them appreciated.

Mr. President, once again our sincere thanks for a most thought provoking Presidential Address which no doubt will bring its influence to bear on an attempt to solve the problems highlighted in your Address.

#### MR. D. H. FRASER: PRESIDENT

Mr. Robson and Mr. Von Ahlften, thank you very much indeed for those complimentary remarks. I am sure I do not deserve them.

## VENUE 1982 TECHNICAL MEETING PLEK 1982 TEGNIESE VERGADERING

CLR. L. VAN RENSBURG: GEORGE

Mr. President, afford me the opportunity to congratulate you and the President Elect on behalf of George on your elections this morning.

Mnr. die President, namens die Stadsraad van George is dit my voorreg om u uit te nooi om die Tegniese Vergadering in 1982 in George te hou. Ons sien uit daarna om as u gasheer op te tree. Die Burgemeester van George het verskoning aangebied dat hy nie self hier kan wees om die uitnodiging aan u te rig. Wees verseker van 'n wonderlike ervaring in George. Baie dankie.

MR. D. H. FRASER: PRESIDENT

Baie dankie, Raadslid van Rensburg vir u uitnodiging. I am sure that we all look forward with much anticipation to enjoying the beauty and attraction of that lovely part of the Cape.

## VENUE 1983 CONVENTION PLEK 1983 KONVENSIE

RDL. C. VENTER: JOHANNESBURG

Mnr. die President, dis 'n besondere eer om u te nooi om u 1983 Konvensie in Johannesburg te hou. In Johannesburg het ons die lokale, ons het hotel akkommodasie, ons is nou nie so gelukkig soos Durban om ook die see te hê nie maar ons het doksels baie sand daar.

I have been authorised by the City Council of Johannesburg, Sir, to extend this invitation to you and I am quite sure that we will be able to work out a programme for you and for the ladies. We have in Johannesburg several museums, including the Gold Mine Museum, which is unique and the Golden City is of course the largest educational centre in the Republic of South Africa. It's the only City in the Republic with two Universities and six Colleges of Education. We have a musical fountain, which is, incidentally, the largest in the world, and the largest abattoir, and largest fresh produce market and, if you come from a farming community, Mr. President, I am sure that you will be interested to know that we have the largest market, and much more.

I now have pleasure in extending to you, Sir, the invitation from the City Council of Johannesburg to hold your 1983 Convention in the City of Johannesburg, the Golden City. Thank you.

MR. D. H. FRASER: PRESIDENT

Baie dankie Raadslid Venter. I trust that in our folders when we have our Convention in Johannesburg, we will find a little bar of gold instead of the bottle of brandy that you were able to share in Durban. We have much pleasure in accepting your invitation.

## CONFERMEN OF HONORARY MEMBERSHIP TOEKENNING VAN ERE-LIDMAATSKAP

MR. D. H. FRASER: PRESIDENT

We come now to a most important item on our agenda, namely the conferment of Honorary Membership of AMEU on three very distinguished persons who have been associated with and rendered invaluable service to the AMEU over many years. This honour is not lightly bestowed but I am sure you will all agree that it is well deserved.

It is my privilege to call on Jules van Ahlften, Town Electrical and Mechanical Engineer of Springs, to propose conferment of Honorary Membership on Mr. Naude van Wyk.

MNR. J. K. VON AHLFTEN: SPRINGS

Meneer die President, dames en here, ek het die aangename taak om 'n voorstel dat ere-lidmaatskap aan meneer Naude van Wyk, Direkteur van die Nasionale Navorsingsinstituut vir Elektriese Ingenieurswese van die WNNR toegestaan word, aan die Konvensie voor te lê.

Ek het hom vir die eerste keer in 1965 by die Konvensie in Port Elizabeth opgemerk alhoewel hy sedert 1964 reeds hierdie Konvensies as die Direkteur van die Navorsingsinstituut bygewoon het. In hierdie tyd het ons hom leer ken as 'n goeie vriend van die VMEQ wie altyd bereid is om ons met advies en hulp te bedien. Hy het nie met voortreflike diens gelewer op die navorsingsgebied vir elektrisiteitsvoorsiening nie maar het ook internasionale bekendheid verwerf op die gebied van outomatisasie en beheer waarvan die onlangse internasionale kongres van die Federasie sal getuig wat in Suid-Afrika gehou is. Dit is aan mense soos Naude van Wyk te danke dat Suid-Afrika op die internasionale wetenskaplike navorsingsgebied steeds erkenning geniet en verwelkom word. Daar dien ook spesiale melding gemaak te word van die uitstaande werk op die gebied van weerlignavoring wat onder sy Direkteur-skap deur die Instituut gedoen word wat vir die VMEQ en ander elektrisiteitsvoorsieningsowerhede van wesenlike belang is.

Meneer van Wyk is tans 'n Vise-President van die Suid-Afrikaanse Instituut vir Elektriese Ingenieurs en ons wil hom ook graag gelukwens daarmee.

Die grondwet van die VMEQ maak dus met reg voorsiening daarvoor dat die Konvensie ere-lidmaatskap aan persone kan verleen wie voortreflike dienste gelewer het op die gebied van die elektriese ingenieurswese as geheel en ek vertrou derhalwe dat hierdie voorstel eenparig deur die Konvensie aanvaar sal word.

Ons vertrou dat ons nog vir baie jare die voorreg sal hê om vir Naude en sy gade, Sophie, by hierdie Konvensies te kan verwelkom. Ons geniet altyd hulle geselskap by ons sosiale geleenthede waar Naude hom ook al onderskei het alhoewel dit 'n tyd geneem het om hom as 'n "oud-Ikey" op te voed en van hom 'n regte "oud-Matie" te maak.



Mnr. J. D. N. van Wyk ontvang sy ere-lidmaatskap tekens van die President.

MNR. J. D. N. VAN WYK: WNNR

Mnr. die President 'n mens word nooit te oud om iets te leer nie. Ek was 'n persoon wat geglo het dat televisie nie die morele standaard verlaag nie. Nou na Dallas is ek nie meer so seker nie. Dat 'n voorbeeldige mens soos Jules van Ahlften so sonder om te blik of te bloos hier voor almal kan staan en jok oor my kon hy alleen by JR geleer het.

Sedert ek gehoor het dat hierdie eer my te beurt sal val het ek natuurlik my kop gekrap oor wat die rede was. Toe Sy Edele die Minister vanoggend sy openingsrede oor energie gelewer het, het daar skielik 'n lig vir my opgegaan. U sal u herinner dat ek in 1975 in hierdie selfde saal ook iets oor energie te sê gehad het. Ek het toe genoem dat die 100 000 joules vereis om die water vir 'n koppie tee te kook terwyl dit slegs sowat 50 000 joules vereis om 'n bottel bier te verkoel. Ek aanvaar dus dat hierdie aanbeveling van energiebesparing uitmuntend ingepas het by die gedagtes van die lede van u Uitvoerende Raad en vandaar my verering.

In a serious vein Mr. President, I have been attending your conventions for a number of years as a guest. I have been impressed with the growth in stature and importance of the organisation over the years. I have been impressed also with the increase in depth and quality of the technical papers over the years as well as the standard of debate. The proceedings of these conventions have indeed become important reference documents in their own right.

For me as Research Director it's been very important to listen to all of you, to have direct contact with those problems which are peculiar to South Africa.

Mr. President, to you and the Executive Council, my sincere appreciation for allowing me to join this very elite, small group of honorary members and I thank you from the bottom of my heart.

#### MR. D. H. FRASER: DURBAN

It is now my pleasure to call on Mr. K. G. Robson to propose Dr. Ralph Anderson for Honorary Membership.

#### MR. K. G. ROBSON: EAST LONDON

Mr. President, distinguished guests, ladies and gentlemen. Dr. Ralph Blyth Anderson was born in Bulawayo, Rhodesia in 1916. After completing his schooling at Bulawayo's Milton High school in 1933 he attended the University of Cape Town where he obtained his B.Sc. degree in Electrical Engineering in 1937.

In 1972 he was awarded the degree of Doctor of Philosophy by the University of Cape Town for his thesis entitled "The Lightning Discharge."

In 1938 he joined the Southern Rhodesian Electricity Supply Commission and remained with the Commission for twenty seven years. At the termination of his service he held the position of Chief Electrical Contracts Engineer. His experience with an electricity supply undertaking with an extensive network operating in a high lightning intensity area set him on the course of a professional career which brought him distinction and honour in his own country and internationally. In 1965 he was appointed to the staff of the Council for Scientific and Industrial Research and is presently Assistant Director, Research, of the National Electrical Engineering Research Institute.

Ralph Anderson is a highly respected and acknowledged authority in the field of lightning research. In his own words this has been his first love and duty and because of its fascination, it might also be called his hobby.

His international professional stature in his field has taken him to many countries. The Research Institute's success in setting up a national scheme in South Africa to measure lightning ground flash density resulted in his being invited to advise on a similar project in Mexico.

In 1979 Dr. Anderson was appointed Convenor of Working Group 33.01 (Lightning) of Study Committee No. 33 of the International Conference on Large Electric Systems at High Tension (CIGRE), after service on the Working Group since 1963.

He was singularly honoured in 1975 by being appointed Chairman of an Ad Hoc Working Group of the International Commission on Atmospheric Electricity to encourage measurement of comparative lightning parameters.

His knowledge and learning and his innovative and leadership qualities have been demonstrated in his outstanding contribution to the electrical engineering profession through the professional institutions. In 1955 he was elected Member of the Rhodesian Institution of Engineers and in 1962 a Member of the Institution of Electrical Engineers (London) of which he is now a Fellow.

He has served on the Council of the South African Institute of Electrical Engineers and was a distinguished President in 1979/1980.

He is the author of many papers, many jointly with colleagues. Down the years delegates to Conventions and Technical Meetings of the AMEU have been privileged to know Ralph Anderson, to listen to him and to learn from him.

I searched for a single word appropriate to his distinguished status in his chosen profession and chose "Luminary" which the Oxford Dictionary gives as "a person of light and lead-

ing". Most surely Ralph Anderson is one of our "Luminaries". In a letter in 1675 Sir Isaac Newton wrote these words to that famous contemporary and antagonist Robert Hooke. "If I have seen further it is by standing on the shoulders of giants".

Many have stood on Ralph Anderson's shoulders — all of us assembled here today honour him.

Mr. President, ladies and gentlemen it is with pleasure and a sense of privilege that I formally propose that Honorary Membership of The Association of Municipal Electricity Undertakings of South Africa be conferred this day on Dr. Ralph Blyth Anderson, Pr. Eng.



*Dr. R. Anderson receives his honorary membership certificate from the President.*

#### DR. RALPH ANDERSON: CSIR

Mr. President, Ken Robson, words fail me to respond adequately on this great honour you have bestowed on me. I have attended your meetings as an observer and a learner for some fifteen years, with one meeting excepted. I came here to learn really, what the problems were of a Municipal Electrical Undertaking and there were many. We at the CSIR were therefore able to assess what the emphasis should be in our research work and how we could help your Association. An example was mentioned by Ken, a moment ago, namely the measurement of 'lightning-flash density'. We now have a five year map of this and I hope Electrical Undertakings will now be able to co-ordinate the designs of 11 KV systems, according to the lightning severity of the area, and thereby save money, especially in rural electrification.

Another line which we have followed largely as a consequence of listening to your problems has been that of measurement of lightning over-voltages on 11 KV lines in particular, these being the most vulnerable to lightning. This work has been undertaken for some years now and is now culminating in a very special, unique experiment in collaboration with ESCOM and has been and will be reported to you by Dr. Andy Erikson, who is here also, as he has been the Project Manager for this project.

There have been other aspects of Electrical Engineering, which have arisen, I think, directly as a consequence of our contact with your Association, namely that of damage to lightning arrestors, problems of earthing in a country where the earthing conditions vary considerably and that of the design of 11 KV and high voltage lines to guard against lightning. So I must thank you, Mr. President, for the long association I have had with your Association and thank you very much indeed for accepting me as an Honorary Member. Your Association has been doing a tremendous amount of work, high-lightning and solving the problems both managerial and technical of Municipal Electricity Undertakings. You have become an extremely viable body, whose voice must be heard in this land of ours. In addition, however, you have welded a bond of friendship amongst your members and I have been privileged to have joined in with you and I thank you very much that I have been included as a friend, within this august company of yours. I think one has only to ask any member of the Association, what were the highlights of any meeting in a particular place or at a particular time and I

think then that one would receive an astonishing array of opinion and experiences, covering the vast field of human endeavour, not all of it technical I might venture to say. This I think, Mr. President, has been one of the special features of your Association, the friendship and the unity and the endeavours that have been carried out in your work and I am greatly honoured indeed to have been made a member of your Association.

Thank you very much indeed, Mr. President.

#### MR. D. H. FRASER: PRESIDENT

Thank you Dr. Anderson. The relationship between the AMEU and the CSIR has been one of very close working and we are grateful for that. I now call on the immediate Past President, Mr. Piet Botes, to propose honorary membership for Mr. John Morrison, who has entertained and charmed us with his wit and skill as a public speaker on so many occasions and hopefully will continue to do so in the future.

#### MR. P. J. BOTES: ROODEPOORT

Mr. President, distinguished guests, ladies and gentlemen, after the second world war, in which he was a Major in the Airborne Force, John Morrison joined Tube Investments Limited as a "Trainee Manager" and was seconded to Simplex Electric Company Limited, Birmingham.

In 1951 Simplex built a factory in South Africa and John Morrison was transferred out here as Commercial Manager — later to be promoted to Commercial Director, and then to Joint General Manager and Director.

After a series of mergers, the original company became AEI Henley Africa (Pty.) Limited in which he was General Manager and Director but, with the purchase of AEI by GEC in 1968, Simplex Electric Company (Africa) Pty. Limited was re-established and, once again, John Morrison became the Managing Director.

It was approximately at this time that John contracted a severe illness. His recovery was due to his absolute determination to walk again. Through all this he has kept his friendly disposition and is a most jovial person at any gathering.

There has also been a merger and subsequent acquisition by The General Electric Company of America and prior to his "official" retirement in 1979, he was Deputy Chairman of the Company. He is now acting in a consulting capacity with both Simplex-GE Lighting (Pty) Limited and Tube Investments (Pty) Limited and holds Directorships within their organisations.

During his career John Morrison has also been Chairman of the SEIFSA, Electrical Division, Chairman of the South African Cable Makers Association and has held Directorships and has been an active member of many committees associated with the Electrical Industry.

He is a Companion of the South African Institute of Electrical Engineers and a Member of the Association of Supervising Electrical Engineers. His connection with the Association of Municipal Electricity Undertakings goes back for almost 30 years during which time he has attended all but two conventions and has participated as a speaker or joint Chairman of the Members Forum in 15 of them. As from 31 July 1959 he represented the Electrical Engineering and Allied Industries Association on the Recommendations Committee for new Electrical Commodities — almost 22 years during which he has rendered important contributions. I have been privileged to know John Morrison since 1962 when I attended my first Convention. At that time John was already a well-known regular AMEU Convention attendee, having first attended the AMEU Convention held in Bulawayo in 1952. John is well-known for his speeches on behalf of the Affiliates at the closing sessions of the Conventions. In particular I will never forget his speech when he proposed a vote of thanks to the ladies during the closing session of that memorable Convention held in Umtali.

Mr. President, Ladies and Gentlemen, it is my privilege to propose formally that Honorary Membership of the Association of Municipal Electricity Undertakings of South Africa be conferred on Mr. J. A. Morrison and I know that this proposal will be unanimously accepted by all present here today.

#### MR. D. H. FRASER: PRESIDENT

Thank you Mr. Botes. I am sure we all agree most wholeheartedly with this proposal. I now ask John to come forward to receive his certificate of honorary membership.



Mr. J. A. Morrison receives his honorary membership certificate from the President.

#### MR. J. A. MORRISON: AFFILIATE

Mr. President, Mr. Botes and distinguished guests, I am deeply moved by the great honour that you have bestowed on me and also by the kind and generous things that have been said. To receive such a tribute — whether completely justified or not — leaves the sort of warm feeling that one experiences when, having invested 2c in a weighing machine, you receive a card which informs you that, at a weight of 70 kilos, you are handsome, successful and irresistible to the opposite sex. For the rest of the day, you wander around on a pink cloud, trying out your newly found talents on some unsuspecting female, when it suddenly dawns on you that the wretched machine has got your weight wrong as well.

Even so, Mr. President, I would like to think that just a little of the kind tribute was true and that my thirty years association with the AMEU will be remembered for at least a short while.

This has been a most rewarding period of my life, during which I have made close friends with so many wonderful people. I have shared with you the joy and pleasures of these Conventions and above all I have been proud to have been the person nominated as Spokesman for the Electrical Industry in this country.

Mr. President, I am very conscious of the fact that I am the first Affiliate to receive this great honour, and that I now join the ranks of those illustrious Past Presidents, Engineers and Councillors who have served your Association so fully in the past years and who have brought such honour and stature to it.

May I thank you and your Council for this wonderful gesture which I readily accept — not only for myself but on behalf of my Company and my Associates here present.

#### MR. D. H. FRASER: PRESIDENT

Thank you, John, we do value your association with us and even more so now that you have joined the ranks of the permanent Members of the Association.

# AMENDMENTS TO THE CONSTITUTION WYSIGINGS AAN DIE GRONDWET

MR. D. H. FRASER: PRESIDENT

The next item of business we have to deal with is the adoption of a new constitution. Much debate and negotiation was necessary to get consensus among the members of the ad-hoc committee charged with the task of reviewing the constitution and I must pay tribute to the hard work put into the assignment by the convenor, Mr. Weasel Barnard.

I call upon him now to outline briefly the background and summarise the proposed amendments.

MR. W. BARNARD: JOHANNESBURG

After sending out a number of questionnaires to all members, the Executive Council has prepared an amended Constitution which we hope will be acceptable to everybody.

Apart from editing and considerable legal redrafting, the following are the significant changes: —

## 1. Qualifications of Members

Engineer Member: Previously an Engineer Member was an Engineer in overall charge of a member undertaking, who held qualifications acceptable to the Executive Council. Such an engineer who did not hold an acceptable qualification was classified as an Associate Member.

From the replies received, it was apparent that the majority of members favoured abolishing the need to hold a qualification. Any person in overall charge of a member undertaking will thus now be classified as an Engineer Member.

The designation "Associate Member" will now apply to those previously classified as "Associates", viz. one or more assistant engineers in the permanent service of a member undertaking. Here again all reference to qualifications has been deleted.

## 2. Executive Council

These clauses provide that every Past President and his Councilor representative serve on the Executive Council as long as he is an Engineer Member. There has been virtually unanimous support for this amendment.

The Executive Council could find no reason for the establishment of Branches and Regions and has consequently abolished the concept of Regions and defined "Branches" more specifically. This clause therefore provides for the election of three Engineer Members in addition to one from each Branch, to be elected by the Convention.

## 3. Duties and Powers of the Executive Council

This clause should be reworded in order to allow the Executive Council to appoint any member to ad hoc committees or as representatives on other committees. It is therefore proposed that this clause should read as follows:—  
"to appoint ad hoc committees of members and to appoint members as representatives on other committees, and to define their powers and terms of reference."

## 4. Amendment of the Constitution

Provision is made that a majority of two-thirds of members present shall agree by ballot to any amendment of the Constitution.

Apart from legal redrafting and editing, the foregoing are the major changes proposed to the Constitution. The Executive Council has based these proposals on the best compromise of the various viewpoints and would therefore appeal to members to give the amended constitution their unanimous support.

MR. D. C. PALSER: CAPE TOWN

Mr. President Mr. Barnard, in his usual eloquent and competent manner, has outlined the background of the new Constitution. There is nothing that I can add to it so I just formally second the proposal that the new Constitution be adopted.

MR. D. H. FRASER: PRESIDENT

Thank you Mr. Palser.

I don't want to assume that the applause necessarily implies full acceptance. Are there any questions? Apparently not. In that case, I would ask if there are any Members who are not in favour of the adoption of the new Constitution as proposed. Thank you, Gentlemen, for the unanimous acceptance of these proposals. I would again thank Mr. Barnard for the hard work that he has put into revising the Constitution which did need some changes.

## ELECTION OF THE EXECUTIVE COUNCIL VERKIESING VAN DIE UITVOERENDE RAAD

MR. D. H. FRASER: PRESIDENT

We have secured the services of volunteers for the scrutiny of the ballot namely Messrs. Nantes Botha, Piet Geers, Gerard Gerber, Bill Lashley, Buddy Nel and Franje van Wyngaard. Will those gentlemen come to the front of the hall and officiate.

Now gentlemen, the new constitution having been adopted, the election of the Executive Council members will take place in accordance with that. Past Presidents who have indicated they are willing to serve on the Executive Council, Messrs. P. J. Botes, K. G. Robson, E. de C. Pretorius, J. K. von Ahlfen and G. Theron are automatically members of the Executive Council and the ballot now is between those who have been nominated from the various Branches. Two are unopposed namely, Mr. E. G. Davies from Natal and Mr. N. S. Botha from the OFS and Northern Cape Branch, so the ballot now is for the representatives from the other three branches, the Highveld Branch, the Good Hope Branch and the Cape Eastern Branch. Those who are entitled to vote, that is the Engineer Members and their Councilors, will have ballot papers in their folders.

Please make sure that you have them, they have the AMEU letterhead and the names of the candidates are indicated on them. I will read them out to you. From the Eastern Cape Branch, Messrs. Adams and Dawson, from the Good Hope Branch, Messrs. Louw, Murphy and Palser, and from the Highveld Branch, Messrs. Fortmann, Loubser, Potgieter and Nortje. You will see at the bottom of the ballot paper that you are to vote for one candidate in each of these three branches and then there are a further three candidates for whom you can vote. You must not vote for more than six out of that list of names. So gentlemen, please proceed with the completion of your ballot papers and then the scrutineers will collect them from you.

## RESULTS OF THE ELECTION UITSLAG VAN DIE VERKIESING

Gentlemen, I can now announce the result of the ballot but before doing so I would like to express thanks to the scrutineers for their assistance in conducting the election of the Executive Council. The newly elected members are as follows:—

Eastern Cape Branch	— Mr. J. D. Dawson
Good Hope Branch	— Mr. K. J. Murphy
	— Mr. D. C. Palser
Highveld Branch	— Mr. D. E. T. Potgieter
	— Mr. J. A. Loubser
	— Mr. A. H. L. Fortmann

May I congratulate those members together with the two unopposed whom I mentioned earlier, Mr. E. G. Davies from the Natal Branch and Mr. N. S. Botha of the Free State and Northern Cape Branch, on their election. They, together with the five Past Presidents and the President and President Elect and their Councilors will constitute the new AMEU Executive Council. May we congratulate them.

**First row/Eerste ry:**

*Ing./Eng. J. K. von Ahlften (Springs), J. D. Dawson (Uitenhage), W. Barnard (President Elect/Aangewese President, Johannesburg), D. H. Fraser (President, Durban), Bennie van der Walt (Secretary/Sekretaris), D. C. Palzer (Cape Town), E. de C. Pretorius (Potchefstroom).*

**Second row/Tweede ry:**

*Clrs./Rlde. A. Heiberg (Roodepoort), Prof. J. S. van der Walt (Bloemfontein), C. J. J. Fourie (Uitenhage), D. E. Biddulph (Verwoerdburg), S. H. Lange (Durban), J. L. Steyn (Boksburg), Eng./Ing. D. E. T. Potgieter (Verwoerdburg), P. J. Botes (Roodepoort), N. S. Botha (Bloemfontein), G. C. Theron en Rld. C. Borchardt (Administrasieraad Oranje-Vaal).*

**Third row/Derde ry:**

*Clrs./Rlde. Prof. P. J. Botha (Potchefstroom), D. de Roos (Springs), Eng./Ing. J. A. Loubaer (Benoni), Clrs./Rlde. D. Taljaard (Benoni), F. van der Velde (Cape Town), Eng./Ing. K. G. Robson (East London), K. J. Murphy (Somerset West), A. H. L. Fortmann (Boksburg) and E. G. Davies (Pietermaritzburg).*

# TRANSFORMERS, MINIATURE & MOBILE SUBSTATIONS

BY

# OAK

## MINIATURE SUBSTATIONS

Manufactured to S.A.B.S. 2029 and 1030

kVA Rating — up to 800kVA  
Voltages — up to 11kV  
Cooling — O.N.A.N. all voltages

The Mini Substations can be supplied with HT & LT switchgear to suit customer requirements.

Our Technical staff hold themselves available to discuss specialised customer requirements.

Available in steel or fibreglass enclosures to suit environment.

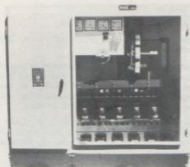


## MOBILE MINI SUBSTATIONS

Of compact design for use in Mining and Industry. Capable of movement, with skids or wheels. Designed and manufactured to meet the highest quality requirements. In similar ratings to those shown above.

## WHEEL ARRANGEMENT

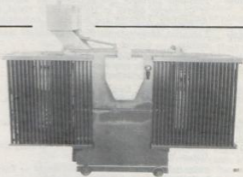
Mobile Mini Substations are fitted with standard uni or bi-directional wheels, either flat or flanged to customers specifications.



## DISTRIBUTION TRANSFORMERS

Manufactured to S.A.B.S. 780 and bearing the S.A.B.S. mark

kVA Rating — 5 to 2 500  
Voltages — up to 11kV  
Cooling — O.N.A.N. all voltages  
Cooling — A.N. up to 1 100 volts  
Phases — Polyphases



**ALSO SUPPLIERS OF:—** Transformers, Sectionalising Switches, HT Fuses, Reactors, Chokes  
A. C. & D. C. and Wire Wound Resistors

**OAK Industries (Transvaal) (Pty) Ltd**

Subsidiary of OAK Industries (South Africa) (Pty) Ltd

Box 82271, Southdale 2135  
Marketing Division  
Head Office:—  
Box 1172, Pietermaritzburg

Telephone: (011) 680-1422

Telephone: (011) 834-1971

Telephone: (0331) 5-1311

Telex: 8-4086SA

Telex: 8-2778SA

Telex: 6-3428SA

# CAPITAL FINANCING OF ELECTRICITY UNDERTAKINGS

By MR. O. D. GORVEN

CITY TREASURER, DURBAN

## MR. D. H. FRASER: PRESIDENT

We now come to the presentation of the first paper to this Convention.

It is often said that "No man is an island unto himself". This is indeed true! Mutual co-operation and understanding are essential to progress and achievement and while we Electrical Engineers may not easily acknowledge this, we cannot do without the accountants and controllers of the pursestrings for the successful operation of our undertakings. Because of this, I prevailed upon my good friend and colleague Mr. Ossie Gorven, City Treasurer of Durban to enter the lions den to speak to us on a subject close to his heart and of considerable importance to all engineers involved in the business of electricity supply namely "Capital Financing of Electricity Undertakings".

Mr. Gorven joined the City Treasurer's Department, Durban, in 1940 after his education at Durban High School. During the war he served overseas with the South African Air Force and returned after hostilities to the City Treasurer's Department. In 1951, he was appointed Personal and Technical Assistant to the City Treasurer, and in 1956, was promoted to the position of Deputy City Treasurer, (Accounting and Finance). In April, 1962, he was appointed to the position of City Treasurer, Durban, and in the same month became a Member of the Council of the Institute of Municipal Treasurers and Accountants and is now the longest serving member of that body.

Mr. Gorven is a graduate of the University of Natal with a Bachelor of Commerce degree. He is also:—

Fellow of the Institute of Municipal Treasurers & Accountants;

Fellow of the Chartered Institute of Secretaries & Administrators;

Fellow of the Institute of Cost & Management Accountants;  
Member of the Computer Society of South Africa.

Other Career — related activities include:—

- 1949-1950 Part-time Lecturer and examiner for Bachelor of Commerce degree at University of Natal, in Accounting, Auditing and Municipal Accounting.
- 1962-date Financial Adviser to the Natal Municipal Association.
- 1962-date Member of the Council of the Institute of Municipal Treasurers and Accountants.  
*President* — 1965 to 1968 and 1975 to 1977.
- 1971-date Member of the Council of the Association of Pension and Provident Funds of South Africa.  
*Chairman* — 1974 to 1975 and 1978 to 1979.
- 1969-1970 Member of Commission of Enquiry — Salisbury, Rhodesia.
- 1972-1974 Member of Driessen Committee of Enquiry into Urban Transportation.
- 1977 Financial Adviser on Local Government — Turnhalle Conference — South West Africa.
- 1979 Member of Slatter Committee of Enquiry into Local Government of Indian Areas.

Gentlemen, I am sure you will agree that we are privileged to have a man of such achievement and experience to address us and it is with much pleasure that I ask Mr. Gorven to take his place at the rostrum.

## 1. INTRODUCTION

- 1.1 Capital financing has many facets which can probably be brought together under three main headings viz:—



Mr. O. D. Gorven addressing the delegates.

- (a) The raising of loans externally;
- (b) The alternative of financing from internal sources; and
- (c) Methods of Accounting Treatment which determine the rate at which the interest and redemption costs involved in either external or internal financing are spread against operating costs of the undertaking over a period of time.
- 1.2 Because there are many alternatives available, it is doubtful whether any two major Municipal Electricity Undertakings in South Africa are financed by identical means.
- 1.3 When Municipal Electricity Undertakings were responsible for both the generation and distribution of supplies, the question of capital financing was of far greater importance to them because, generation being a capital intensive operation, the interest and redemption charges formed a far greater proportion of total operating costs of a municipal undertaking than is now the case where only distribution is involved.
- 1.4 The capital financing of generation is now almost entirely in the hands of Escom and policies adopted can, as you are aware from the events of a few years ago, have a significant effect upon cost and tariff structures.
- 1.5 However, leaving generation aside, there are still considerable capital sums involved in the distribution and maintenance of an electricity undertaking and the interest and redemption charges averaging some 10% of total costs of the major municipal electricity undertakings are still so significant that they require careful consideration.

## 2. RAISING LOANS EXTERNALLY

- 2.1 I do not intend to cover the mechanics of raising loans externally other than to say that, when capital market conditions are difficult, the borrower is not free to determine the basis upon which he will raise capital and you will be aware that, particularly in



- recent years with the combination of high inflation rates and capital market rates which have for a period of time yielded negative real returns to the investor, it became extremely difficult for borrowers to raise Funds over conventional long-term financing periods.
- 2.2 There were reasons for the negative real interest rates. In the first place, the insurance and pension fund industries are forced to hold 53% of their assets in Government Stocks or other prescribed investments which include semi-gilt stocks issued by Escom and municipalities. This therefore forms a captive market, a matter to which the de Kock Commission has been giving attention and which many commentators expect to be reduced in size or phased out completely over a period of time in favour of a free market economy.
- 2.3 It seems to me that the best allocation of scarce resources is ultimately achieved by allowing free-play in the market place and, if investors have complete freedom in choice of how to invest their capital, this will certainly result in a change in the utilisation of capital at this juncture which will bring in its turn a change in the relative yields earned by capital in the various classes of investments which are available viz. fixed interest loans, equities, property etc.
- 2.4 This brings us immediately to a brief consideration of the effects of inflation upon investment and investment yields. You will all be aware of the growth of the "equity cult" of the early 1960's and of the fact that a structural change took place in the relative between yield rates on shares which up to that time had been regarded as a form of risk investment and hence were expected to give a better return than could be obtained on the then "safe" gilt or semi-gilt stocks. Those were of course times of low inflation rates, but even then investors began to perceive that fixed interest stocks gave a relatively poor performance in yield and return of capital in inflationary conditions, whilst dividends on shares and their capital value could be expected to grow with the growth of enterprises which they were financing. Risks of course were not eliminated entirely, but nevertheless this approach became so strong that it resulted in the advent of the so called "reverse yield gap" where yields on shares were actually lower than those of the "safe" fixed interest stocks.
- 2.5 With the higher rates of inflation that have become evident since the 1960's and particularly in the conditions of the last few years where double digit inflation has been experienced, the reverse yield gap has now become the norm and "inflation-proofed" equities are now regarded as the "safe" investments whereas investments in fixed interest stocks are known to produce declining incomes in real terms and a reduced real value of capital upon repayment of the debt.
- 2.6 This has naturally driven up fixed interest rates but, until such time as investors feel satisfied that the rate on money which they are lending over a particular period of time will more than match the likely inflation rate for that period of time and give them a real return on their money, fixed interest borrowing is likely to become progressively less popular which will of course in turn push up the price of this method of financing. As already indicated, the other tendency will be for loans to be granted for shorter periods, particularly because of the impossibility of forecasting inflation rates of future years. In these days of managed economies there are so many decisions both nationally and internationally which affect the inflation rate that no-one is able to say precisely what course inflation will follow over the years, particularly for so long as the world lacks the type of discipline which was inherent in the old goldbacked currency systems.
- 2.7 Yields on property investments which are, of course, also a form of equity investment, have not been as low as those on equities, although there is still a reverse yield gap relative to fixed interest stocks although of smaller proportions. This is probably due to the fact that the property investments, whilst also forming a very good hedge against inflation, are more difficult to negotiate and are considerably less marketable than their equity counterparts. To some extent this has been offset by the advent of the property unit trusts or the shares of property owning companies, both of which can be marketed fairly easily.
- 2.8 The point to be established here is that with uncertainty about inflation and particularly with high inflation rates, fixed interest borrowing will become progressively more difficult unless interest rates are increased considerably in order to compensate for the risks. This is the pattern one finds in Britain and America where similar and sometimes worse inflation problems have existed. In recent months, fixed interest rates have increased rapidly, and it would not be surprising in the three months that will elapse between the publication of this paper and its discussion at the Conference, that further rises have occurred. Maybe by that time, the 14% usury rate will have been abandoned, and positive real returns relative to the inflation rate will be a possibility, especially if the compulsions upon Pension Funds and Insurance Companies have been moderated.
- 2.9 The other general comment about the fixed interest market is that interest rates tend to vary in accordance with the economic cycle. When the level of economic activity is low, the demand for capital for new enterprises likewise falls off, but capital continues to grow in the capital generating institutions such as Pension Funds, and Insurance Companies and the oversupply results in a drop in interest rates.
- 2.10 Here again, however, inflation can have its effect and this was demonstrated during 1980 in South Africa where despite a fairly low level of demand for capital (the economic upswing only recently having got under-way) traditional long-term fixed interest investors deliberately held back considerable sums from the long-term market because fixed interest rates were so low by comparison with the then inflation rate and were content to accept lesser yields in the form of short-term deposits with the banking and building society movements. This action had the result of driving up long-term fixed interest rates fairly sharply and simultaneously making it impossible to obtain Funds in any quantity for a 20 year loan period.
- 2.11 The whole position would also be influenced materially if we were to move towards an open economy rather than being subject to the strict foreign exchange controls which have existed up to now, as the position in overseas capital markets would then also influence our own local situation far more directly than is the case at present. Perhaps there will also be some developments in this sphere between the time of preparation and discussion of this paper.
- 2.12 The State appears to be moving towards a greater participation by free enterprise and possibly a freer economy so that interesting times are ahead in the capital market for all of those who rely on getting their capital from this source.

### 3. INTERNAL CAPITAL FINANCING

- 3.1 Having regard to the difficulties experienced in the capital market from time to time and the high interest rates which are payable in order to obtain Funds, particularly in times of high inflation rates, it is useful for an Organisation to provide at least a portion of its capital financing requirements from

internal resources and most major electricity undertakings follow this practice.

3.2 The original method of financing in this way was to make a contribution from current revenues towards capital financing. In other words, the whole or a part of the asset was "paid for" from current or operating account, and no borrowing or interest and redemption charges were then involved.

3.3 Whilst this policy has advantages, it is particularly subject to a "stop-go" approach, especially if decisions have to be made from year to year by public representatives who are subjected to pressure from the ballot box.

3.4 This led to the development in South Africa in the 1950's of the Capital Development Fund/Revolving Fund approach, in terms of which any amounts appropriated from operating account are transferred to a Fund. That Fund then makes an advance in respect of the capital asset acquired and future operating accounts are called upon to bear interest and redemption charges on these advances which are then repaid to the Fund for use in further capital financing.

3.5 This means of course that the operating account (that is in effect the electricity consumer), is asked to make a contribution twice, but having done this, the advantage is that in future years, the repaid capital on the advance and the interest thereon (or a part of it) becomes available for making yet further advances for capital financing purposes. This then results in a system in which a permanent capital is built up and will continue to grow from interest earnings alone, regardless of the annual decision as to whether or not to augment the Funds by further appropriations from operating account.

3.6 There are advantages to the consumer of this "double" payment. Firstly, it is a form of insurance to provide for adequate future electricity supplies for him, and of course new consumers. Secondly, depending upon the treatment of interest earnings, it can result in a partial counter to future electricity cost increases, apart from the unknown downward pressure which internal financing effects upon the external interest rate pattern.

3.7 There is a remarkable variation in the operation of Capital Development or Revolving Funds in South Africa and I think that it is true to say that the legislative conditions governing the Fund operated by Escom and the Funds operated in each of the four Provinces are all fairly significantly different. In view of the importance which this financing medium has developed in South Africa I propose to deal with this system in a little more detail.

### 3.8 Single Purpose capital development funds

3.8.1 A single purpose capital development fund is set up with the sole objective of providing a source of capital financing in order to minimise external borrowing. Such a fund would make advances at the full interest rate normally payable on external borrowings. The interest and redemption payments accrue to the fund, where they become available, together with other moneys, for the financing of further capital expenditure of the local authority, thereby reducing the need to borrow externally.

3.8.2 Under this system the revenue or operating account does not benefit from any interest savings, but the rate of growth of the capital of the fund is greater than for dual purpose capital development funds, where one of the objectives is to make interest savings on revenue or operating account.

3.8.3 An example of the single purpose capital development fund is that operated by Escom, though in this case the accumulations in the fund are not used for making advances in respect of individual assets but are invested in

Escom's public loan issues, and the entire interest earnings accrue to the fund itself.

3.8.4 Further examples of single purpose capital development funds can be found in those local authorities where advances from the fund are made at the interest rate which is applicable to the advances of the consolidated loans fund. As the latter interest rate represents the average interest rate applicable to external borrowings, there would be no interest saving to revenue or operating account by comparison with external borrowings, and the fund would accordingly be a single purpose one.

3.8.5 In the short run, the rate of growth of a capital development fund based on the Escom system, where the interest rate earned by the fund is determined by current market interest rates, may well differ from the rate of growth of the alternative type of single purpose fund where advances are only made on the average external borrowing rate. The difference in growth of the two types of fund in any one year would depend on the extent to which the current market interest rate differs from the average external borrowing rate of all loans outstanding. In the long run, however, there should be little difference between the rates of growth of these two kinds of single purpose capital development funds.

### 3.9 Dual purpose capital development funds

3.9.1 A dual purpose capital development fund has two objectives, viz:—

(a) to build up capital; and

(b) to reduce the interest burden on the revenue or operating account.

3.9.2 If the interest burden on the revenue account is to be reduced either directly or indirectly, it means that the rate of growth of the capital development fund for a given annual contribution will be lower than that of the single purpose fund.

3.9.3 There are two basic methods whereby the interest burden on revenue or operating account can be reduced, viz:—

(a) by making advances from the capital development fund at a lower interest rate than the market rate on external borrowings; or

(b) by making the advance from the capital development fund at the current market interest rate, but instead of crediting the interest earnings to the capital development fund, allocating them in full or in part to the revenue or operating account of the local authority.

3.9.4 The merits and demerits of these approaches will be discussed more fully under the heading of "Interest Rate Policy".

3.9.5 A considerable variation in policy is possible in dual purpose funds as to the extent to which interest relief is to be obtained on the one hand, and the growth of the fund is to be sacrificed on the other. It is possible to regulate the position by making advances at interest rates varying from 0 per cent up to the full external market rate. Alternatively, if interest on advances is to be charged in full at market rates (which in my view is the preferable course of action), the proportion of interest earnings which accrue to the fund as against the operating or revenue account, can vary from 0 per cent to 100 per cent.

### 3.10 Interest rate policy

3.10.1 As the objective of a single purpose capital development fund is to minimise external borrowing and not to make savings on interest, this logically means that all advances should be made at current market interest rates. A local authority operating a consolidated loans fund for its external borrowings could make capital development fund advances at the same average external interest rate which is applied to its consolidated loans fund in order to avoid differences in the two methods of financing, but in the long run, this comprises a market rate approach.

3.10.2 It would have the effect however, in times of rising interest rates, of retarding the increase in average rates as the local authority, by virtue of having capital development fund moneys available, would have to borrow less on the open market at the most recent higher external interest rates and hence its average rate on the consolidated loans fund would be lower than would otherwise have been the case. The converse is true when interest rates fall below the average consolidated loans fund rate.

3.10.3 In the case of dual purpose funds which seek to ensure a reduction in the interest charges borne by revenue account, however, the extent of the reduction would be affected by the policy approach which is adopted.

3.10.4 The first alternative is to make advances at less than the external market rate, in which case the revenue or operating account obtains the benefit of a lesser interest charge. Under this approach, the value of interest saving is not apparent, and is difficult to calculate when advances have been made over a long period of time.

3.10.5 It is accordingly preferable to charge the full economic interest cost on the asset to revenue or operating account and in so doing, also to ensure that different methods of financing do not invalidate cost comparisons, and then to allocate interest so charged between the fund on the one hand, and the revenue or operating account on the other. The net cost to revenue or operating account is then the full interest charged less the portion of interest re-credited to the account.

3.10.6 The method of charging interest at the full current market rate but splitting the interest earned in the desired proportion between the capital development fund and the operating account, is the most advantageous course of action because:—

- (a) cost comparisons between projects financed in a different manner are not invalidated;
- (b) new projects are embarked on in the light of full interest costs and thus economic considerations are properly taken into account in the decision-making process; and
- (c) the precise value of interest savings resulting from the operation of the capital development fund is readily visible in the accounting system, and does not have to be calculated or debated as would be the case where sub-economic interest charges are levied.

3.10.7 The last aspect is of extreme psychological importance as local authorities can indicate to the public how the operations of the capital development fund are achieving interest savings and therefore helping to balance their budgets.

3.10.8 From what has been said, it is clear that the Capital Development Fund is not held in the form of cash or investments, which are subject to erosion of value by inflation. The assets of the Fund are real assets in the form of land, buildings, plant, mains etc., thus protecting the Fund from loss of value by inflation.

3.10.9 Furthermore, the Capital Development Fund will soon develop a strong growth factor if it is credited with interest, due to the power of compound interest earnings. Modest annual contributions to the Fund of, say, 5% of revenue, will soon result in a strong capital financing medium, from which it may be possible to finance all new capital projects and reduce external loan debt as well.

3.10.10 I believe that the Capital Development Fund financing system has come to stay and that greater reliance will be placed on it because of the development needs of the country as a whole and the demand which this will make on available capital resources on the one hand and because of the erosion of the real value of capital by inflation on the other hand.

3.11 In suggesting this, I am of course assuming a higher long-term average real interest rate by comparison with the long-term average inflation rate as any other assumption could only lead as its corollary to the disappearance of the fixed interest capital market because lenders would not be prepared to invest at fixed interest rates as nett real losses would occur year after year. There is, at present, a compulsion on Pension Funds and Insurance Companies to invest in fixed interest stocks, but this compulsion would become untenable if negative real interest rates persisted, because it would mean that the pensioner or the provident man who saves for the future would be subsidising (in our context) the electricity consumer.

### 4. METHODS OF ACCOUNTING TREATMENT

4.1 This brings us to methods of accounting treatment which determine the rate at which the interest and redemption costs involved in either external or internal financing are spread against operating costs of the undertaking over a period of time. In this regard, a number of systems operate.

#### 4.2 Loan Redemption Fund

4.2.1 Under this system, interest is paid on the original amount of the loan for the full period of the loan and the redemption of the loan is provided for by charging against operating account in annual provision for redemption which amount, together with interest earnings thereon, is sufficient to accumulate to the full amount of the sum originally borrowed.

4.2.2 When a loan redemption contribution is charged to operation account, it is necessary to take this into account when assessing tariffs in order to obtain sufficient income to ensure a balanced budget. A portion of each electricity bill paid by the consumer is therefore attributable to the redemption contribution, and the cash so derived then becomes available for the purchase of an investment equivalent to the annual redemption contribution. Furthermore, the interest earnings received on the investments made year by year provides further cash for the purchase of investments so that with a relatively small annual contribution to a loan redemption fund the effect of compound interest earned is such that the full amount of the loan ultimately becomes available in the form of the investments purchased year by year. Upon maturity of the loan the investments can then be sold and the proceeds utilised to repay the stockholders.

- 4.2.3 In the meantime, the loan redemption fund is credited each year with the annual contributions, together with the interest earnings on the investments so that it also accumulates to the full value of the original sum borrowed and is available to write off wasting assets. In other words, it performs the function of a depreciation fund as well as ensuring that cash is available from which to purchase investments in order to ensure the repayment of the loan at maturity date.
- 4.2.4 If permanent assets such as land have been acquired from the loan, then the accumulation in the loan redemption fund is available to finance such assets on a permanent basis. In effect, in the case of permanent assets, the system ensures that electricity consumers build up a capital fund to finance such assets.
- 4.2.5 Inevitably there is a variation year by year in the actual interest earnings of the loan redemption fund compared with the anticipated interest earnings when the annual contribution was first calculated. These differences are often corrected by periodical actuarial adjustments to increase or decrease the annual contributions to take into account surpluses or deficits in anticipated interest earnings.
- 4.2.6 The loan redemption fund system is used by Escom, which body even goes so far as to investing its Capital Development Fund appropriations together with the interest earnings thereon from time to time in public loans issued by Escom, the redemption of which is then provided for in the loan redemption fund system.
- 4.2.7 This means that, whether at any point of time Escom assets are internally or externally financed, the interest and redemption costs are the same and are market related. Furthermore, the system means that each capital project bears the costs to which it gives rise at the time of the borrowing for the purpose of financing that project.
- 4.2.8 Where it is not possible, due to market conditions, to borrow the Funds over the desired financing period of, say, 25 years, then it is possible to borrow for a shorter period of, say, 7 years, and nevertheless provide for the loan redemption over a period of 25 years. This means that at the end of the 7 year loan period stockholders must be repaid from the proceeds of a new loan issue to replace the one which is being repaid. This process is known as a re-issue or a re-borrowing of a loan and will almost certainly mean a change in the level of interest costs during the 25 year financing period. Naturally the total of the periods over which the several loans are issued must ultimately coincide with the 25 year loan redemption fund period.
- 4.2.9 When loans are re-issued or re-borrowed, the loan redemption fund is normally left undisturbed so that it (and its associated investments) becomes available to repay the final loan in the 25 year series, and it can, at that stage, also fulfil its depreciation fund function. However, it is possible to utilise the partial accumulation of investments at the time of re-borrowing to repay a part of the original loan, and then to re-borrow a lesser sum for the balance of the 25 year period.
- 4.2.10 A disadvantage of the loan redemption fund system is that, if assets having a shorter life than the loan period are purchased from the loan, the redemption fund cannot adequately fulfil its depreciation fund function because the fund will only be fully built up at the end

of the loan period, whereas the asset will be worn out and will need to be written off and replaced before the loan is repaid. This has led to the provision of depreciation or "renewals" contributions in respect of such assets, and usually results in a measure of surplus provision in the loan redemption fund at the end of the loan period.

#### 4.3 Annuity Repayment System

- 4.3.1 Under this system the amount is borrowed on the basis that it will be repaid usually in yearly or half-yearly instalments throughout the loan period so that the books will show a reducing annual interest charge over the years and an increasing annual redemption charge, but with the total sum of interest and redemption remaining constant. This contrasts with the loan redemption fund system in which both interest and redemption costs remain fixed year by year, except for variations in the redemption provision due to actuarial adjustments from time to time.
- 4.3.2 This method of financing is not popular with large investors and is not utilised to any significant degree in the South African capital market. This is largely because investors do not like their capital being returned in portions over the loan period and also because debenture stocks are not as marketable as conventional loan stocks.
- 4.3.3 In the annuity system, the appropriation of the amount in respect of loan redemption from operating account is the equivalent of the provision for depreciation and that portion of the loan having been repaid the amount concerned is credited to a "loans redeemed account" from which the asset concerned can ultimately be written off (or, if it is land, permanently financed). Because the redemption provision is equivalent to the amount of the loan actually repaid year by year, the total credit in the loans redeemed account will ultimately be the same as the original amount of the loan issued. In these circumstances, cash for the repayment of the loan becomes available because, as in the previous case, the tariffs paid by consumers, allow for the loan redemption element which has been charged to operating account.
- 4.3.4 If it were possible to invest loan redemption fund contributions together with interest earned thereon, at the same interest rate as applied to the original stock issue, then the annual interest and redemption charges under the loan redemption fund system would be exactly the same as those under the annuity system. However, in practice, yields on investments of the loan redemption fund will vary year by year and the loan redemption fund system will be "cheaper" than the annuity system if the average yield on investments on the loans redemption fund exceeds the interest rate at which the loan was issued, whilst the converse is also true.

#### 4.4 Straight-Line Repayment System

- 4.4.1 This system is identical to the annuity system but almost unknown in external loans, although quite commonly used for repayment of internal advances, particularly in the Consolidated Loans Fund system or the Capital Development Fund system. The only difference is that the rate at which capital is repaid exceeds the rate of capital redeemed under the annuity system. Hence interest costs on the balance of the loan are lower because the capital balance on the loan reduces more rapidly than under the annuity system.

- 4.4.2 It will be evident that with a constant capital repayment each year, and a reducing interest charge, the total annual cost reduces year by year under the straight-line system.
- 4.5 Consolidated Loans Fund System
- 4.5.1 The Consolidated Loans Fund system is in common use in most major local authorities.
- 4.5.2 The system works on the basis that a capital fund (the Consolidated Loans Fund) is set up to stand between the external investor who lends money to the undertaking and the sub-account of the undertaking which requires the capital to finance its capital outlay. The Consolidated Loans Fund merely borrows from the external investor and undertakes to repay that borrowing on a specified date. There is no legal compulsion to build up investments in order to ensure an ability to repay the loan on due date and the investor has to rely entirely on the management of the Fund when his stocks fall due for repayment.
- 4.5.3 Once the loan has been raised and paid into the Consolidated Loans Fund, the Fund advances money internally to the sub-account of the undertaking which requires the capital. This sub-account is then called upon to repay the amount, together with interest to the Consolidated Loans Fund on the basis of half-yearly or annual instalments of interest and redemption. The redemption can either be on the straight-line or the annuity system. The annual interest and redemption charges are met from an operating account in the same way as if the advance had been raised from an external source.
- 4.5.4 The amount of interest paid to stockholders is debited to the Consolidated Loans Fund, and this amount, after deduction of any interest income which may accrue to the Fund from external investments which it may hold, is recovered from operating accounts pro-rata to the balances outstanding on the advances made by the Fund.
- 4.5.5 The treatment of the repaid capital by sub-accounts to the Consolidated Loans Fund is, however, significantly different from the loans redemption fund or annuity systems in that these amounts do not have to be invested in trust for repayment of the loan (as in the loan redemption fund system) or repaid to the stockholder direct (as in the annuity system). These amounts accordingly become available for advance to sub-accounts for further capital outlays which have been incurred in the interim. This means that the resources of the Consolidated Loans Fund must be carefully managed and the borrowing operations of the local authority must be carefully timed to ensure that, when a loan is due to be repaid to an external stockholder, the money from which this is to be done is in fact available. For this purpose there are often short-term investments built up within the Consolidated Loans Fund system and available monies can be utilised in this manner rather than for the purpose of making new advances to sub-accounts if a loan redemption is imminent.
- 4.5.6 Under this system the aggregate external indebtedness of the Organisation is lower than would be the case under the Loan Redemption Fund system, but would be approximately the same as that under the annuity system or the straight-line system depending upon which method of capital repayment is utilised within the framework of the Consolidated Loans Fund advance arrangements to sub-accounts.
- 4.5.7 However, the basis upon which interest is charged to sub-accounts calls for special comment.
- 4.5.8 The Consolidated Loans Fund system is based on the philosophy that the average interest rate on all borrowings should be charged on the balances of all advances made by the Fund to sub-accounts, regardless of the ruling interest rates at the time at which the advances were made. The justification for this approach is held to be that the operating account of a particular project should not be burdened with exceptionally high interest rates just because that project happened to be undertaken at an expensive time in the capital market and that, conversely, other operating accounts should not receive the advantage of particularly low interest rates which may have been prevailing at the time their projects were embarked upon.
- 4.5.9 Whilst there are obvious advantages to such an approach, especially when it is applied to a single purpose authority such as an electricity undertaking, complications and possibly inequities arise when a Consolidated Loans Fund is operated by a multi-function municipality.
- 4.5.10 Furthermore, the operation of such a fund tends to mask the true interest charges which arise from any new project, as the costs of any new loan are merged with the interest costs of past loans, and the new project is called upon to bear only the average interest rate applicable to all advances of the Fund. This means, in a multi-function environment, that substantial investment in, say, a sewerage scheme at a time of higher than average interest rates will cause electricity tariffs to rise even though the electricity undertaking may have had no new capital outlay at all. At the same time, users of the sewerage system are paying too little.
- 4.5.11 The attempted justification for this situation is that the law of the swings and roundabouts applies but, for this to function satisfactorily, the volumes and consistency of expenditures on all functions would have to be considerably greater than is the case in this country. Furthermore, the procedure may well result in projects being allowed to proceed at times when normal economic laws would suggest that the project should be deferred, if at all possible, because of the high cost of borrowing.
- 4.5.12 From discussions with those operating a Consolidated Loans Fund system it is clear that there is also considerable difficulty in deciding how best to report upon the costs of a proposed project. If, for example, a project necessitates the borrowing of R1 million at an interest rate of say 10%, the problem will be to know whether to indicate that the interest cost is R100 000 per annum or whether to report that the average rate of loans issued from the Consolidated Loans Fund is only 8% and that the project involves only the R80 000 interest cost which will ultimately come through the books. The balance of R20 000 is, of course, still incurred and has to be borne by increased interest charges on all past projects on which advances are outstanding.
- 4.5.13 Because of this kind of problem, operators of the Consolidated Loans Fund system have, on occasion, resorted to making fixed interest advances at current market rates to finance nominated projects and this confirms that the interest averaging system is not desirable in all situations. The Caps Provincial legislation makes provision for market related rates to be charged for advances to trading undertakings and certain other operations, and this

represents an interesting departure from the norm.

- 4.5.14 A possible modification of the system would be to charge interest on advances at the market rate at the time of the advance, but this would then result in an under or over recovery of interest by the Fund relative to the amounts required to be paid to stockholders. If there is an over-recovery this could readily be handled by placing the amount in an equalisation account, but under-recoveries would have to be spread amongst projects, presumably proportionate to the direct interest costs already charged against them.
- 4.5.15 In the long term, the average Consolidated Loans Fund rate will equal market rates but, with interest rates rising and falling, there will be a time-lag between the average rate of the Fund and the actual market rate ruling from time to time.
- 4.5.16 When interest rates are rising after a long period of stability, the Consolidated Loans Fund system will give the impression that it is cheaper to operate than the conventional borrowing arrangements because average interest rates will be lower than current market rates. However, when interest rates start dropping, the market rate will drop until it is ultimately below the average Consolidated Loans Fund rate, then giving the impression of the Consolidated Loans Fund being expensive relative to conventional borrowing systems.
- 4.5.17 Thus far, we have assumed that the Consolidated Loans Fund will obtain all of its monies from external loan sources, but there is nothing to prevent the undertaking concerned from "investing" internal funds in the Consolidated Loans Fund should it so desire. This can be done either at specific interest rates or at the average rate already being paid on external borrowings. The former basis seems to me to be preferable but, in practice, the latter is often used.

#### 4.6 Premature Redemption of Loans

- 4.6.1 Another technique in capital financing is to provide for the redemption of loans over a shorter period than normal. This can be accomplished in two ways.
- 4.6.2 Under the first method, one can deliberately borrow money (or repay internal advances) over a shorter period with the object of limiting interest costs when interest rates are high. One might elect, for example, to finance over 3 years an asset normally financed over 25 years. In this case, the interest cost would be payable for only three years, but the redemption cost during this period would be high. The financial advantage of the transaction is obtained after the third year when the loan is fully repaid.
- 4.6.3 If this policy were to be adopted, it could be eased in on a gradual basis by financing, say, 10% of the capital outlay for that year on a three year basis, and doing the same in the second and third years, during which three-year period high interest and redemption costs would be experienced due to the abnormal redemption component. However, if the policy is continued in the fourth year, the abnormal redemption component will be partially offset by the interest no longer payable on the first year's loan, and thereafter the position will improve (relative to long-term financing) and within a few years the interest savings will more than offset the abnormal redemption charges. When this stage is reached, one could increase the three-year financing from 10% to 20% of capital outlay without burdening the

finances of the undertaking, and this process could continue over the years until such time as the percentage of capital outlay financed each year on a three-year basis reaches the level desired.

- 4.6.4 A second method of achieving short-term financing is possible where there is a system of internal advances under the Consolidated Loans Fund system or Capital Development Fund system. In such cases, although the advances may have been made over conventional long-term periods, the organisation can, if it so wishes, repay such advances prematurely in the event of unanticipated funds becoming available. If, for example, the operating account of the undertaking ended the year with a surplus, that surplus could be utilised to repay prematurely some of the advances outstanding. The surplus on operating account would be eliminated by making an extra redemption charge, whilst the surplus cash which arose from the operations would be used to repay the Consolidated Loans or Capital Development Funds prematurely. This cash would then become available for new advances by these Funds. Such an approach would result in a gain to operating account in future years in the form of lower interest and redemption charges and the period for which the operating account would benefit would depend upon the period still outstanding on the advances selected for premature repayment.
- 4.6.5 This method of dealing with surpluses also has the advantage of eliminating the saw-tooth effect of carrying forward varying surpluses from one year to another, particularly when in the second year no surpluses arise. In such an event, tariffs would have to be put up not only to handle normal cost increases for the coming year, but also to handle the shortfall in revenue of the preceding year which was met by the credit balance brought forward. The technique of repaying advances prematurely therefore results in smaller tariff increases more often and also in the provision of extra internal capital finance because of the premature capital repayments which have taken place.
- 4.6.6 Depending upon the relative interest rates on the advances repaid and on the interest which could be earned on the balance carried forward until it is absorbed by costs there may also be an interest profit in following the premature redemption approach. This is because, generally speaking, short-term interest rates are lower than those which are applicable to advances, though this is not always the case. The main advantages, however, are the elimination of the saw-tooth effect on tariffs and the smoothing of revenues and costs on operating account, together with the provision of extra internal capital finance.

#### 4.7 Inflation Accounting

- 4.7.1 Inflation accounting, which is now making some impact overseas in the private sector, and which has, to the extent of depreciation provisions, been used for some time by Icor, the Post Office and the South African Railways, has not yet found its way into municipal accounting systems.
- 4.7.2 In the case of Escom, the recent Board of Trade report expressed the view that the extent to which it was making contributions to its Capital Development Fund (some 25% of total income, together with interest earnings on past contributions to the Fund) was roughly the equivalent of providing depreciation on assets on the basis of replacement costs. It was accordingly recommended that ESCOM should change its approach and provide for assets at replacement values rather than contribute to

its Capital Development Fund, but this recommendation was not adopted. Under either method, capital is generated for financing purposes, but the extent would obviously vary depending on changes in asset replacement costs from time to time.

4.7.3 Municipal Electricity Undertakings generally do little more than provide for depreciation on the historical cost of assets, though limited Capital Development or other Reserve Funds are being built up. In these circumstances, present day consumers are not paying sufficient to replace that part of the physical assets which they are "using", and so are gaining in real terms at the expense of later consumers who have to foot the bill of plant replacement at high costs.

4.7.4 Some would say that there is no harm in only providing for historical costs because, when the plant is replaced, the then cost levels should be within the capacity of people to pay (despite the tariff increases which may be involved at that time) and the survival of the undertaking would not be in question as may be the case in the private sector.

4.7.5 There can be many hours of interesting debate on the subject of inflation and its effect on financial policies. The main thrust, however, should rather be to tackle the root causes and to bring inflation under control than to have to try to patch up the problems which inflation causes.

## 5. CONCLUSION

5.1 The financing of any undertaking is necessarily a dynamic process and municipal electricity undertakings are no exception. Change must be initiated to respond to the needs of the times and, as we look at the possibilities which lie ahead, it seems likely that new techniques and approaches will be required. However, there are basic financing principles which must necessarily be present in whatever variations we may evolve, and these must be preserved if the basically sound financial structure of municipal electricity undertakings is to be maintained.

## DISCUSSIONS BESPREKINGS

### MR. W. BARNARD: JOHANNESBURG

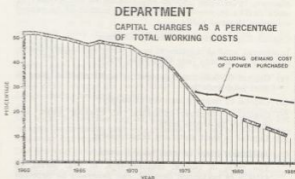
I am privileged to be able to contribute to Mr. Gorven's paper which will certainly fill a gap in the vast store of knowledge and information which we have gathered in the Proceedings of the AMEU over the years.

Mr. Gorven is probably one of the most prominent, certainly one of the most enlightened City Treasurers in the Republic, and Durban, which is able to meet its capital requirements from the Capital Development Fund, is certainly the envy of Municipal Electrical Engineers.

Electrical Utilities are known throughout the world to be capital intensive, but South Africa is one of the few countries where Municipalities still buy power in bulk from a national grid and sell to their individual consumers.

Mr. Gorven has mentioned interest and redemption charges averaging 10% of the total costs of major municipal electricity undertakings. Figure 1 shows how in Johannesburg the percentage of capital charges has dropped from 50,83% in 1960 to 18,80% in 1980. However, I do not believe this gives the full picture of capital expenditure, because Johannesburg started purchasing power from ESCOM in 1972 and in 1980 imported 325 MW. In analysing capital costs, there appears to be justification for including all demand related costs, viz. annual capital charges on power generating and distribution assets as well as demand charges, in the case of purchases of power from ESCOM.

## JOHANNESBURG ELECTRICITY



JOHANNESBURG ELECTRICITY DEPARTMENT FIG. 1

The addition of this information in Figure 1 tends to cause a levelling out at just under 30% of total costs. This figure will, however, vary for different municipalities for a number of reasons, including cost of purchasing power.

The capital financing of electricity supply undertakings has certainly been a complex and very often vexed problem for Municipal Treasurers, but the investment of this capital is equally complex. I would therefore like to consider possible methods of determining "productivity" of capital investment. At first blush one might consider a direct commercial approach as appropriate, and compare income (sales) with expenditure (all costs, including capital charges), and determine productivity from the percentage surplus (profit) produced. This approach is not acceptable for a number of reasons, the most important obviously being

- The supply authority has a monopoly and within limits, can set his own tariffs and produce an arbitrary surplus.
- The major cost factor for non-generating authorities is the purchase of power, the tariff for which varies from one region to another.
- Local consumer conditions vary from one authority to another viz. load density, diversity of load, annual load factor, etc. all outside the control of the supplier.
- Municipalities are required to provide service functions which are non-revenue producing i.e. street lighting, festival illuminations, communications, traffic control systems, etc.

A second approach could be to relate the capital charges of capital invested in distribution and generation assets plus demand charges of power purchased to annual maximum demand of the undertaking.

In Supplement No. 2 of the 1974 report on Standardisation of Financial Statements of Local Authorities, prepared by the Institute of Municipal Treasurers and Accountants, reference is made to what is considered to be the best performance ratios to use for various activities, and in the case of an electricity undertaking the recommended "Units of Output" are:—

Electricity	
Generation and/or purchase	Number of units set out
	Number of units sold
	Maximum demand
	Load factor
Distribution	Number of units sold
	Number of consumers
	Percentage loss in distribution
Street lighting	Number of lamps

Of these "Units of Output", only Maximum Demand relates directly to distribution and generation capital expenditure. However, where power is purchased, the demand charges should be added in lieu of interest and redemption charges on the bulk supply authority's capital invested in generating and transmission plant. It might be of interest to note that this proposal was in fact accepted by the Johannesburg Treasury when leasing charges on Gas Turbines costing R18 million, were added when analysing patterns of capital expenditure. Unfortunately, Treasury officials, through lack of

technical understanding, arrived at completely erroneous conclusions, by relating capital expenditure to the number of units (kWh) or number of consumers, instead of to annual maximum demand (kW).

#### Capital Expenditure and Demand Charges

In general, capital investment in an electricity supply undertaking will fall into four categories, viz.

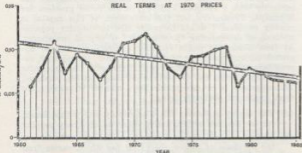
- Capital for additional generating or distribution plant to meet load growth
- Capital to improve security of supply
- Capital to improve utilisation of existing plant, and therefore to reduce costs
- Capital to meet statutory requirements.

#### (a) Additional Plant to meet Load Growth

The ratio of capital requirements, in real terms, to growth in maximum demand, can generally be expected to fall, due to new technology, greater diversity, higher density and an improved annual load factor. (Figure 2).

### JOHANNESBURG ELECTRICITY DEPARTMENT

INCREASE IN DISTRIBUTION CAPITAL INVESTMENT  
PER MW INCREASE IN DEMAND  
REAL TERMS AT 1970 PRICES



JOHANNESBURG ELECTRICITY DEPARTMENT FIG. 2

#### (b) Improve Security of Supply

The amount of capital required to maintain and improve reliability of supply is generally decided by policy, but Cost Benefit Analysis can also be applied.

#### (c) Better Utilisation and Cost Reduction

The capital required to reduce costs by either better utilisation of existing plant or reducing demand charges, should be justified as a viable proposition in relation to the expected savings according to acceptable formulae such as that used for capitalisation of transformer losses

#### (d) To Meet Statutory Regulations

Capital is required to install plant to meet statutory regulations in respect of clean air legislation, water purity, design and construction of transmission lines, architectural treatment of substations, etc.

The following Johannesburg projects can be categorised as follows:—

#### (a) Load Growth

- |  |              |
|--|--------------|
| (i) Fordsburg Bulk Supply Substation         | R10 million  |
| (ii) Delta Bulk Supply Substation            | R12 million  |
| (iii) Ridge 80/11 kV Distribution Substation | R2,5 million |

#### (b) Security of Supply

- |                           |             |
|---------------------------|-------------|
| (i) Gas Turbines          | R18 million |
| (ii) Supervisory Control  | R3 million  |
| (iii) Workshop facilities | R18 million |

#### (c) Cost Reduction

- |                               |               |
|-------------------------------|---------------|
| (i) Coal handling facilities  | R4,3 million  |
| (ii) Retubing of boilers      | R5,0 million  |
| (iii) Auto condenser cleaning | R2,0 million  |
| (iv) Load control system      | R13,0 million |

#### (d) Statutory

(i) Smoke emission control

R6,2 million

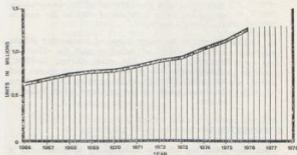
From the foregoing it can be seen that the percentage of the capital charges of operating costs cannot be used as a measure of efficient capital investment.

### ENERGY OR OPERATING COSTS

These costs, which include maintenance, do not relate to capital expenditure, but a measure of their efficiency could be determined by the number of kWh (units) sold per employee. The graph of these figures for Johannesburg from 1966 to 1980, shows that the figure was 648 878 for 1966, compared with 620 560 for Britain. Over the past 10 years the figure for Johannesburg has increased by 97%, to 1 277 696. (Figure 3)

### JOHANNESBURG ELECTRICITY DEPARTMENT

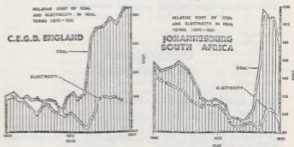
UNITS SENT OUT/EMPLOYEE



JOHANNESBURG ELECTRICITY DEPARTMENT FIG. 3

The CEBG has also graphed the "average electricity prices in real terms for the period 1960/1980" for coal-fired power stations and this exercise has also been carried out for Johannesburg with surprisingly similar results.

(Fig. 4)



C.E.G.B. ENGLAND FIG. 4

These graphs show that electricity prices "in real terms" have not increased over the past 20 years in spite of significant increases in coal price.

### TOTAL POWER COSTS

Electrical power is no longer a luxury, but a major essential service and the objective of any supply undertaking should be as set out by the CEBG, "to aim to meet the demand the customer puts on us . . . to do this securely . . . to do this as economically as possible, while having due regard to our statutory duty to protect the environment".

The measure of how economically and effectively we are carrying out these objectives can only be based on a study of the change in power costs in real terms. From Johannesburg's statistics it cannot be disputed that the Electricity Supply Industry in this country has a proud record of productivity and efficient investment.



Mr. Gorven has given us a comprehensive overview of the financing policies being followed by the municipalities and also by ESCOM in their tasks of financing electricity generation and distribution. I believe he chose to be more informative as opposed to controversial and I was happy to notice that he made no proposals concerning dramatic or immediate changes. This is commendable as the topic requires clarification rather than change if electricity consumers are to be satisfied that the financing goals of ESCOM and the municipalities are being achieved.

From the ESCOM experience I could elaborate on some points raised:

1. Mr. Gorven addressed the "negative interest rate" conditions which have ruled on the financial markets during recent years. He claimed that the prescribed investment requirements promoted this phenomenon. This claim I do not oppose, but I wonder if investors' expectations that high inflation is only temporary, could be a contributing factor. Inflation has caused a structural change in the financial markets, but the full impact of inflation on long term investment has been hard to gauge. There does not appear to be a simple relationship between inflation and long term public investment in 1980. Rates rose quickly but many factors beside inflation contributed to the rise. Here I am thinking of all the talk concerning "the free market" and the expectations arising from the De Kock Commission.

2. I have to differ with Mr. Gorven on the choice of a word. He stated that a fund such as ESCOM's Capital Development Fund (CDF) is used in order to "minimise" external borrowing. Instead of "minimise" I prefer "reduce". Of the internal funding funds he discussed, the CDF type used by ESCOM provides the most internal finance but it should be stressed that ESCOM CDF's objective is to provide adequate, not maximum, internal finance.

He rightly stated that consumers pay twice for assets financed by ESCOM's CDF, but it should be remembered that in the long term this reduces the amount that has to be set aside to the fund. Interest earned by the fund which is paid for by consumers reduces the same consumers' CDF contribution. The double payment is taken into account in setting the CDF contributions.

3. ESCOM has the opportunity of costing internal finance out at rates different from those ruling in the financial markets at the time. Reasons why we do not follow this path are:

- (a) ESCOM desires to have a consistent pricing policy which is not influenced by whether the money comes from internal or external sources.
- (b) There is the contribution rate and interest earning link in determining the level of internal financing which I have already mentioned.
- (c) It will be a deviation from incremental pricing policy which, where it can be easily implemented, is preferred above other pricing principles.

4. Mr. Gorven discussed some accounting treatments all of which have been examined by ourselves in the ESCOM context. Our current accounting practice was clearly spelt out by him — we make no differentiation between internal and external finance and all finance costs are market related. Escom believes that its current practices serves both ESCOM constituents, the investor and the electricity consumer, well.

The Capital Development Fund has been a good addition to ESCOM's financing sources. Investors, especially foreign bankers, have expressed their satisfaction that ESCOM is making a good contribution to its financing needs.

I am happy to have heard Mr. Gorven cover the CDF and other electricity pricing principles so well. As I said earlier, before promoting changes a good understanding and appreciation of current practice are needed.

In mnr. Gorven se leersame referaat bevoer by die Nasionale Elektriesiteitsondernemings tans nie meer die verantwoordelikhed het vir die finansiering van kragontwikkelings-fasiliteite nie. Hy wys daarop dat die koste verbonde aan die

rente en delging van kragontwikkeling baie hoër is as die koste verbonde aan distribusie. Hierdie groot las van finansiering — en dit is vandag 'n baie groot en moeilike las — berus nie meer by die Munisipaliteite nie, maar wel by EVKOM.

In terme van die geldwaardes van 1981 is EVKOM se behoeftes aan kapitaal vir die dekade wat voorlê ongeveer R14 000 miljoen. Ongeveer twee-derdes van hierdie reuse bedrag word benodig vir nuwe kragstasies en die aanverwante hoogspanningstransmissielyn.

Die finansiering van R14 000 miljoen is geen geringe taak nie, maar die bestaan van die Kapitaalontwikkelingsfonds het 'n byna bo-menselike taak een gemaak wat, wys insiens, wel uitgevoer kan word.

Die bou van groot steenkool-kragstasies by steenkoolmyne en die bou van die meegaande nasionale transmissiereël het die Munisipaliteite nie slegs onthef van groot kapitaalverpligtinge nie, maar het ook geleid tot groot besparings in koste van elektrisiteit aan munisipale verbruikers.

This is indeed a dogmatic statement, but it is a statement that can not be refuted. Allow me to state to you the interesting fact that the average selling price per kWh for ESCOM in 1980 was, if expressed in real terms, lower than the corresponding figure for 1960. By the way — for the benefit of the economists — you can use whatever deflator you like, and you will reach the same result!

This statement is true with the consumer's contribution to the CDF included; without it the 1980 price is approximately 80% of the 1960 price!

#### MR. E. G. DAVIES: PIETERMARITZBURG

The paper by Mr. Gorven has been very interesting. I would make the following points:—

It is conceded that electricity supply has become less capital intensive since generation was taken over almost entirely by ESCOM. However, in comparing electricity supply with other private operations, it is still very capital intensive. For instance, the Council which I represent has an annual income of approximately R29 000 000. Its capital assets are also approximately the same amount, so that the ratio of annual turnover to assets is very nearly 1,00.

The perusal of some company reports indicate this ratio to be in the case of a large newspaper group 2,4 and a diverse industrial group 3,25. It is therefore essential even if generation is not undertaken to consider carefully the method of providing capital.

The question of provision of capital funds from tariffs is one which has caused considerable discussion recently. However, it is possible to consider this aspect from a purely mathematical view point and this was done in a paper by Mr. Norman of ESCOM published in the Journal of the South African Institute of Electrical Engineers. The results of this mathematical analysis indicate that if the interest rate equals the capital growth rate then the annual cost of financing entirely by loans and the interest rate entirely from revenue is identical but if the interest rate is less than the capital growth rate it is more favourable to finance entirely by loans. Unfortunately the Council has other considerations to be taken into account and the plea is often heard particularly at the time of the estimates that the present generation should not subsidise the future generation. This is only partly correct, because the bulk of consumers will be with us for many years to come and capital financing should be arranged to the best advantage over a period of time.

City Treasurers in general do not pursue a flexible policy by which in times of high interest rates tariffs are adjusted to provide for capital expenditure whereas in time of low interest rate the converse is the case and capital should be provided ex loans. This I would suggest is one of the main functions of a Council's financial administrator.

In Natal, it is necessary to pay between 3 and 5% of income into a capital development fund, but the actual contribution varies from Council to Council. My own view is that the contribution should be as high as possible. I also agree with Mr. Gorven that the interest rate payable to the capital development fund should be the full market rate. This would not only tend to build these funds up more rapidly but would also avoid the practice by some municipalities of utilizing this fund for sections of the Council which have not contributed

to it, i.e. what in fact happens is that the electricity department is not permitted a re-advance of its total contribution but some lesser amount which means, in this context, that it has to borrow dearer money whereas some other section of the Council obtains the cheaper money contributed by the electricity department. I would suggest it would be interesting for other electricity departments to take a close scrutiny of the accounts to see that they are not being victims of this type of bookkeeping.

While talking about the provision of capital, one problem which bedevils medium size electricity departments is that the capital requirements approximately every 4 to 5 years have to provide sums in the order of R3 000 000 in order to build a new major substation and this capital is required in addition to the normal requirements. Despite the fact that the electricity department provides a 3-year estimate setting forth its requirements, it is invariably found that when the time arrives to spend the extra capital the City Treasurer throw up his hands in horror and tries either to cut the normal capital requirements drastically, or to get the electrical engineer to defer projects.

It is of interest to note that this department has done a careful study of the effect of increasing the capital development fund contribution from 3 to 5% over a 10-year period and it is estimated that the net saving by doing so would amount to R1 500 000. Notwithstanding this, it is difficult to persuade the Council to move in this direction because it now requires as much income as possible to sustain its operating account. If I am to digress slightly it appears to me that municipal city treasurers have been singularly unsuccessful in persuading the authorities that extra sources of income have become vitally important to ensure the survival of the municipal system of financing. Considering municipal operations as a whole, this is now becoming critical. For instance, salary increases are continuously being made — quite rightly so in view of inflation — but when the financial authorities are taxed as to where the money is to come from they appear to have nothing more to offer than great faith that something will turn up which, in fact, has not been the case since the days of the Borkenhagen Commission.

There are two other points I would make, firstly, that electricity departments have to be provided with capital funds to be from loans or from revenue because consumers are continuously being connected to the system, domestic and industrial areas are being developed, etc. and these have to be provided with electricity. It is not practicable to recoup these costs through connection fees. This does not arise as far as other departments are concerned; for instance, if the Council finds itself short of funds, it is not obliged to build roads, bridges, parks, etc. This point seems to be totally overlooked by City Treasurers who tend to decide the allocation of capital to the electricity departments purely on the basis of what they are in a position to raise on the capital market.

The second point is that the cost of providing electricity to layouts, both economic and sub-economic, has escalated to such an extent that the capital cost of financing this supply will have an ever increasing effect on loan repayments, thus forcing tariff increases at regular intervals. It seems to be unfair that consumers of the older generation should be called on to bear increased tariffs to provide supply to the newer consumers due to high capital costs but how this can be overcome is not clear to me.

#### MR. D. C. PALSER: CAPE TOWN

Mr. Gorven is to be congratulated on the lucid manner in which he has outlined the mysteries of municipal financing. No mention, however, was made of the various forms of contractor financing that are available today, namely export guarantee loans, suppliers credit and leasing packages.

In Cape Town in recent years we have successfully and profitably employed these sources. For instance, in excess of R20 million out of the total cost of the Steenbras pumped-storage scheme of around R65 million was financed by way of relatively cheap, short-term, overseas loans.

These loans were made available at an effective interest rate, inclusive of favourable forward exchange cover and front-end charges, of around 9% to 10% redeemable over periods ranging from 5 to 7 years. At the time local rates were in excess of 12%.

It is appreciated that the redemption of short term loans can place an unduly heavy initial burden on the service concerned but it is nevertheless felt that this slight disadvantage is more than offset by the more favourable economic considerations.

The financing of Cape Town's second gas turbine, which has just been commissioned, was done by way of a most unusual and sophisticated leasing package to the financial advantage of the City.

Mr. Gorven's comments on these methods of financing municipal capital projects would be appreciated.

Turning now to internal financing it is, I believe, common knowledge that Durban municipality has an extremely healthy capital development fund and has not had to resort to the capital market for many years now. But exactly how far should one go with such internal financing? In the private sector it is generally accepted that all capital funding cannot be from equity sources alone and that recourse must, to a certain extent, be had to debt capital as well. In point of fact, because of tax considerations in the private sector, debt capital is generally cheaper than equity capital. But what exactly is the position in the public sector? Is there not also some optimum ratio between the amounts of equity and debt capital? If so, what factors determine this relationship? Presumably, as internal financing sources are effectively retained earnings, one important factor will be the relevant opportunity costs, namely either the opportunities foregone within the municipality or externally by the electricity consumers or ratepayers themselves. Under certain circumstances it is then not possible that debt capital could well be cheaper than the opportunity cost of capital in the capital development fund?

If, however, complete internal financing via a strong capital development fund is the ideal objective, what upper limit should be aimed at?

I would be grateful if Mr. Gorven could comment on this question of optimum capital structure in the public sector, particularly in the municipal context.

#### MR. H. R. WHITEHEAD: DURBAN

Having had dealings with Mr. Gorven and having a lot to learn on the subject of financing, it is not without trepidation I make the following fundamental observations. In financing an Electricity Undertaking one should first pose the question — "Which method is to the benefit of the consumer?" However, as Electricity Undertakings enjoy monopoly rights I wonder whether the question has become — "Which method is the least difficult for management?"

Secondly, it is a fact that the introduction of CDF's increases costs and therefore will increase tariffs if tariffs truly reflect costs.

The argument that in later years the tariffs benefit from the interest derived from the fund is questionable. As the consumer has contributed to the fund are the interest payments therefore not clearly a *right* rather than a *benefit*?

In section 2.4 Mr. Gorven draws attention to the trend for investors to move away from fixed interest stocks in favour of investments where capital growth rather than high interest rates would be achieved. By introducing a CDF consumers are being forced to invest their money in what could be termed safe or semi-gilt stock at a time when, as the author admits, such type of investment is no longer favoured. Another drawback to investing in the CDF is that it is equivalent to buying stock with an infinite redemption period. Imagine trying to sell stock on the open market which offers normal interest rates but could never be redeemed, yet this is what the consumer is forced to do!

In paragraph 3.6 the author considers the double payment to be a form of insurance to provide for adequate future electricity supplies. However, with the State Treasurer's imposition of limits on expenditure from temporary borrowings, this "insurance" sometimes cannot be provided physically.

There is little doubt that under adverse market conditions there can be an advantage in internal financing, but should this not be operated in such a manner that it becomes a smoothing device to avoid borrowing at unfavourable interest rates or to provide finance if the capital market dries up.

In present inflationary conditions it is better to borrow externally, as stated in paragraph 3.10 and purchased assets

are not subject to erosion by inflation. This applies whether they are internally or externally financed. In either case the lender suffers the loss of value by inflation so at such times it is better for the lender to be external rather than internal. Lastly, on inflation accounting, this strikes me as being one certain way to ensure that inflation stays with us and I therefore hope that we never introduce it.

#### MR. O. D. GORVEN: DURBAN

Thank you Mr. President, and thank you for the discussions arising from my paper. I might say, Mr. President, I felt at home earlier on, but now that I have been criticised I really feel at home, because that is what I am used to!

Mr. President, it is quite true that when you are looking at capital charges in our particular situation, where some local authorities are generating, some are partially generating and others are not generating at all, one cannot look at the overall percentage of capital charges to total operating costs. And if one wants to bring into perspective the aggregate capital charges, then there is a case for including at least some portion of ESCOMS maximum demand charges — probably the major portion because I think that the composition of ESCOM's maximum demand charge comprises about 70 per cent capital charges and 30 per cent other costs. Someone can help me there perhaps.

The capital charges figure I mentioned in my address, Mr. President, related only to the distribution section of the undertakings because I realise that you could not compare total capital charges when some undertakings generate and others do not. 10 per cent is about the proportion of costs which is absorbed by capital charges on distribution and if you remember the slide which Mr. Barnard put up, Johannesburg's figure almost came down to that 10 per cent level and then it was lifted back again by putting in some of ESCOM's demand charges.

The question of measurement of output is a difficult one. I personally believe, Mr. President, that no man outside of an undertaking can tell a man within the undertaking exactly how he should measure. I think this is a matter for joint agreement. You may decide that there are various possibilities for measuring output. I don't believe there is a single one — not for electricity nor for most other undertakings. A combination of several indicators is needed to give a feel as to efficiency. If there were a single simple indicator we would all have discovered it long ago. Maximum demand is a good indicator when looking at capital charges. The number of consumers is not satisfactory, because we might have a few big consumers or a lot of small consumers and the same goes for kW hours sold. Nor does the number of employees gear exactly with maximum demand or kW hours. But these are all indicators and I believe the selected indicators need to be agreed between the technical men and the men handling the finances, and that these should then be studied with the aim of reaching greater efficiency.

Security of supplies is terribly important and also touches on something that Mr. Davies said. The problem of cutting back the capital budget. Now somewhere along the line the managers of the undertakings must try to get into reasonable layman's terminology the margins they are operating on, because there are problems at the decision-making stage. Unless you can come up with something that says we have a margin of x per cent here, y per cent there and z per cent over there, nobody really knows what margin you are working to. Therefore the allocation of capital becomes a question of subjective judgement. Is he putting on his belt and braces and something else as well to make sure that he will never have an interruption in supply, or has he come so close to the margin now that we are risking some area going down once a week? This is the problem. Somewhere along the line, Mr. President, you need to develop a quantifying system that can come across easily to the decision-maker.

Mr. Smith, thank you for your comments. I agree that what I said was informative more than critical. If I had felt there was something wrong with ESCOM's approach I would have said so. I realise that democracy has some part to play and that where there are alternatives someone's else's opinion might be just as good as mine when it comes to policy issues. However, there are some absolutes from which you can't move, and I think I was quite critical of the interest allocations arising from the consolidated loans fund system, be-

cause I believe this distorts the decision-making and the accounting process. I believe that should be changed, but I have no quarrel with the basic ESCOM system — I think it is sound. I also believe that the CDF system is sound because this country needs capital and we should create it however we can, but in as painless a way as possible.

Mr. Whitehead has raised the whole question of internal financing of an undertaking. This is something which happens both in the private and public sectors. You will be very familiar with the difference between earnings yields on Company shares and the dividend yield, the difference being "ploughed-back" to strengthen the internal finances of the Company. It is quite likely that it would be "better" for the shareholder if the full dividend were distributed and the Company then borrowed to finance its requirements, particularly if the earnings yield which the Company was capable of achieving on capital employed exceeded the borrowing rate. This however, should be contrasted with the public sector financing where the return on plough-back cannot be compared with equity earnings as there are none and one has to fall back on the comparison between interest rates and the inflation rate which, as I said in my address, was also a subject for a separate paper. In the long term it is the expectancy that investors will earn a positive return on their money, that is something on average in excess of the average inflation rate over the long term. Many people feel that this "natural" real rate of interest is 3% per annum. What we are seeing at the present time is a short term period of negative interest rates but, if this were to persist indefinitely, the fixed interest lending market would go out of existence, i.e. apart from any compulsory investment requirements which, as I pointed out, exist at present but which may be reduced or ultimately eliminated following the recommendations of the De Kock Commission.

What we do not know, is the future course of inflation, nor the future course of interest rates, but I think it can be asserted fairly strongly that on average interest earnings on long term investments must exceed the erosion in value of money by inflation and, in these circumstances, where there is a dual purpose Capital Development Fund in terms of which consumers obtain some of the fruits of the financing arrangement, there will be an ultimate benefit to the consumer.

The question of the use of internal capital to fund expenditure in times of high interest rates is also interesting — i.e. if one knows precisely what man-made decisions are going to be taken which would cause interest rates to rise or fall. There is however, as I have said, a general trend following economic activity and, if the internal financing sources are not adequate to finance all of the capital outlays, the question of timing of their use is certainly important. Looking at the other side of the coin, the timing of borrowing from external sources is important and I think most financiers endeavour to enter the market at the most favourable times, but here again, they do not always have the option because in the interests of an orderly capital market the State Treasury draws up a programme of time-slots a year in advance with six-monthly revisions and this also makes it difficult to maximise one's position.

In my paper I did say that I was not intending to go into the detail of the actual raising of loans. This is, in itself, the subject for a full and very interesting paper. What Mr. Palser says, is of course, correct, and one has to look at the several alternative possibilities of financing to enable one to decide which is the best in all of the circumstances.

At times, overseas loans in their normal markets can be advantageous and, where export credit schemes are available, these too are generally more economical than other forms of finance. It is also true that in the past, local authorities were able to obtain favourable forward exchange cover for such transactions, but regrettably, this is no longer the case and the Government considers that in its free market economy approach, various bodies wishing to operate on overseas markets (with their approval of course) must stand on their own feet.

Local authorities also had a wonderful but short-lived time in the lease financing sphere where the lessee's tax advantages arising from such a transaction could be passed on to a considerable degree to local authorities. This method of financing was particularly favourable over short periods and many of us raised substantial sums at negative interest rates to finance plant. It gives one quite a nice feeling when one bor-

rows money to have the position where, instead of the borrower paying interest on the loan, the lender actually pays the borrower. But, as I said, this was shortlived, although the transactions we did were embarked on in the full light of day and with the knowledge of the State Treasury, and now legislation blocks us or the lessee from receiving the fruits of any tax advantage in a situation like this. One can, of course, still raise money by means of lease financing, but then without the tax advantage which is generally more expensive than other methods.

How far one should go with internal capital financing is largely a matter of opinion, but in the Natal legislation it does say that one should go as far as one needs to in order to meet one's full needs. This particular point was the subject of a Commission of Enquiry in Natal, but that body decided that, in the circumstances then prevailing, the Natal law should remain unchanged.

It is quite true that in the private sector it usually pays to "gear" one's equity capital by borrowings, simply because it is usually possible to obtain a greater yield on capital employed in business than the cost of borrowing. This operation therefore, has the effect of pushing up yields on the equity portion of the enterprise. This situation is not present in public sector financing where no equity capital is available and where, under conventional financing systems, the cost is the same whether internal or external loans are utilised, provided market related rates are used under all conditions.

However, the gain comes when a lower than market rate is used, or alternatively a share of the income earned by the internal fund is passed on to the electricity consumer. The latter is the system we use in Durban and we have now reached that fortunate stage where having generated the full capital requirements of our electricity undertaking, we can enjoy an annually growing Capital Development Fund and at the same time a nett contribution from the operations of that Fund in reduction of tariffs.

I myself feel that provided contributions appropriated from income each year are moderate — by that I mean not more than 5% of income — coupled with some benefit to consumers in the form of lower interest burdens, thus giving a nett drain on the resources of the undertaking of less than 5% of income, the process of capital generation should be allowed to continue unfettered. We do have a problem at the present time of abnormally high rates of inflation, which makes it difficult for our internal funds to grow as fast as the rapidly annually increasing budgets but, in the long term, changing interest rates should compensate for this and make it reasonably feasible to carry on with capital generation without burdening consumers unduly.

Opportunity costs, of course, are something which can be debated at great length. One would really have to know exactly what the consumer would have done with the money you are denying him because of slightly higher tariffs. If it were to

be paid out in dividends, what would the recipient have done with his cash? If it is an individual consumer how would he have adjusted his budget? I do not think one could easily reach a conclusion on this subject in these particular circumstances, though I do have the feeling that when it comes to the man in the street, he would be likely to spend that little extra rather than save it for the vitally needed capital pool to sustain development in this country. In these circumstances, I would rather make sure that the capital is, in fact, generated by building it up.

Well, thank you Mr. President, I think that is all I wanted to say except that I am quite ready to accept the suggestions that Treasurers have not got hearts. If we had we would all be subject to continuous nervous breakdowns.

#### MR. A. H. L. FORTMANN: BOKSBURG

I assume that some non-revenue earning departments in a local authority do not contribute to a capital development fund but receive benefits from such a fund.

If this is the case, does it mean that a department, like an electricity department, makes contributions to a capital development fund, which presumably is a pooled fund but, because other departments are also drawing on this fund, the contributing department is not able to draw on the fund to the degree of contribution?

Do treasurers take account of this aspect and is it of any importance or consequence?

#### MR. O. D. GORVEN: DURBAN

If a separate Capital Development Fund is not kept for each operation of the Municipality (e.g. Electricity, Water, Rates and General, etc.) it is possible for an undertaking to contribute to the Fund but not to benefit. In Natal, separate Funds are kept for each undertaking, and the interest benefits accrue to each separate fund. If the interest rates levied are less than market interest rates, the position could still be inequitable in that the capital monies available can still be lent via the Consolidated Capital Development Fund to other undertakings, which then get the benefit of the lower interest rates.

Only if separate funds are kept and marked related interest rates are used, can financial equity be assured.

#### MR. D. H. FRASER: PRESIDENT

Thank you Mr. Gorven for a very interesting and thought provoking address to us. We do appreciate it very much indeed and I am sure we have all benefitted by your paper, the very easy manner in which you presented it and the able manner in which you handled the discussion. I would like on behalf of the AMEU to present you with one of our ties so that you can join the ranks of the elite and show off amongst your Treasury friends.

## STREET LIGHTING — LET'S BE PRACTICAL

By R. S. YATES

T.Eng.(C.E.I.), C.G.I.A., F.C.I.B.S., F.A.P.L.E., F.I.L.E.S.A.

#### MR. D. H. FRASER: PRESIDENT

We start off today's proceedings with a down to earth treatise on a subject that is of very real concern and interest to all Municipal Electrical Engineers, i.e. the lighting of our streets and highways.

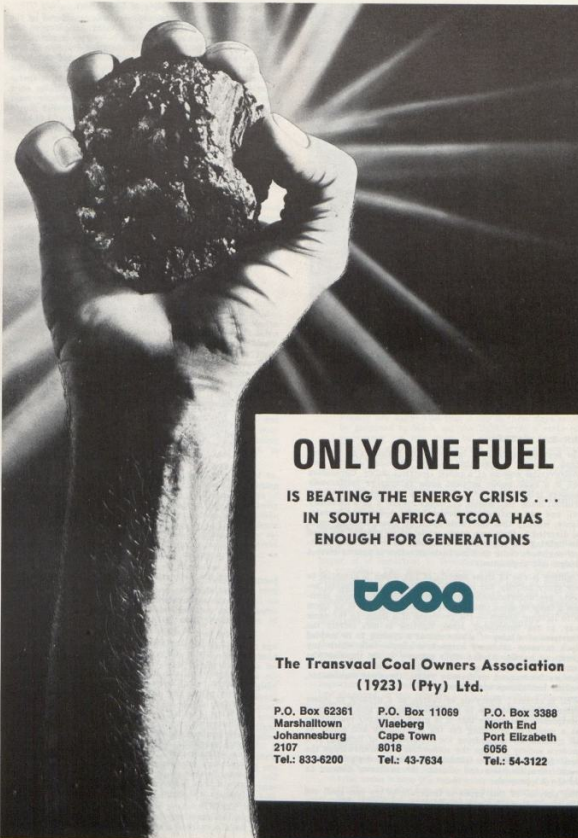
Our speaker is very well qualified and experienced in the subject and I am sure that we are all looking forward to his presentation.

Robert Yates was born and educated in Pretoria and attended the Natal University College in Durban. He later specialised in Illuminating Engineering and obtained Diplomas in the subject from the Illuminating Engineering Society and the City and Guilds of London. In 1970 he was awarded the City and Guilds Insignia Award for a thesis on the subject "The Principles affecting Suburban Street Lighting". He is a Fellow of the Chartered Institution of Building Services and a Fellow of the Association of Public Lighting Engineers of South Africa.

In 1966 he joined the City of Johannesburg Electricity De-

partment and as the Lighting Engineer in the Department, is responsible for all lighting design and maintenance on municipal freeways and roads, commercial and industrial lighting and exterior security, sports and floodlighting installations. He is also actively involved in the design and operation of the annual Christmas Illuminations in the city. In 1973 he was given an overseas study bursary by the Automobile Association of SA to investigate aspects of light and road safety. His report was published by the AA in 1974.

He is one of the founder members of the South African National Committee on Illumination and the Institute of Lighting Engineers and is a past President of both organisations. He was appointed to the Action Committee of the International Commission on Illumination (CIE) in 1975 and was re-appointed at the quadrennial session in 1979 in Japan. He is the South African representative on the CIE Technical Committee dealing with road lighting and at the Warsaw meeting in 1980 was appointed Chairman of a subcommittee to investigate and report on the requirements of residential and industrial road lighting and its effect on crime and the lighting of pedestrian areas and civic centres.



# ONLY ONE FUEL

IS BEATING THE ENERGY CRISIS . . .  
IN SOUTH AFRICA TCOA HAS  
ENOUGH FOR GENERATIONS



**The Transvaal Coal Owners Association  
(1923) (Pty) Ltd.**

P.O. Box 62361  
Marshalltown  
Johannesburg  
2107  
Tel.: 833-6200

P.O. Box 11069  
Vlaeberg  
Cape Town  
8018  
Tel.: 43-7634

P.O. Box 3388  
North End  
Port Elizabeth  
6056  
Tel.: 54-3122



Mr. R. S. Yates addressing the delegates.

#### MR. R. S. YATES

The provision of lighting in streets and highways by a municipal authority is probably one of the most emotive and controversial aspects of a public electrical utility. Councillors call it a basic public service; some ratepayers vociferously support this while others claim it is an environmental intrusion; many distribution engineers regard it as a necessary evil and pay perfunctory service to its design and maintenance, wishing that the funds spent on street lighting could be diverted to their own needs, while others support the need for lighting but argue about standards to be provided; lighting engineers claim that too little attention is paid to correct design and application.

Lighting is one of those aspects of life which is essential to our every activity but its true application and technical aspects are unfortunately frequently ignored. Everyone changes a lamp at some time and to the majority this is all there is to lighting design — the provision of a lamp. In the same way, to the uninitiated, street lighting is also merely the provision of a lamp of a size and at a spacing to be decided upon in some arbitrary manner, a simple task which any clerk can handle. At the other extreme is the theorist who converts street lighting to road lighting and argues about surface luminances, uniformity ratios, threshold increments, veiling luminances and glare.

Who is correct? Everyone of course, to a greater or lesser extent. The problem is to put street lighting into its correct perspective and ensure that it is given its proper recognition as a means of providing for the convenience and safety of all citizens. By recognising the significance of lighting in a modern society perhaps the authorities will acknowledge the need for a reasonable standard of lighting, design it on a more scientific basis and allocate the necessary finance to do the job properly.

The purpose of this paper is therefore to try and spell out the true reasons for providing lighting, suggest appropriate standards for different types of streets and propose methods by which the design work can be nationally adopted in practice.

#### 1 The Convenience and Safety of Road of Roads

As long ago as 1937 this objective was considered by the Ministry of Transport in the United Kingdom as the prime function of street lighting — and so it remains to this day, with the one possible additional function of providing an aspect of security to residential and industrial property. The road user must in this context include the driver of a vehicle (be it a large pantechonicon, a sports car or a bicycle), and the pedestrian either walking on a pavement or crossing the road. Every road user must pay licence fees and rates to a local authority and should therefore be entitled to use the street safely and in comfort at all times.

#### 1.1 Accident Reduction

The aspect of street lighting and reduction of accidents has been covered at length by the Author and in many publications of note throughout the developed world. It would be superfluous to do more than summarise the conclusions here.

In essence properly designed street lighting can reduce night-time road accidents by 30% or more. South Africa has the unenviable reputation of having one of the highest road accident records in the western world and this applies proportionately to every race group in the country.<sup>(1)</sup> We cannot afford to let this drain on our people and resources of skill and manpower continue at its present pace. Any investment to reduce this disastrous state of affairs can only be to the benefit of every individual and the country as a whole.

From an analysis made of data given in the 1979 annual report of the Chief Traffic Officer of Johannesburg, 1.5 times as many night accidents and 2.2 times as many casualties occur on Johannesburg roads without lighting compared with those which are lit. If the 1979 night accidents on the unit roads of Johannesburg (and there are still in the order of 300 km of these) could have been reduced by the provision of adequate lighting, the accident costs based on data compiled by the CSIR could have been decreased by R2.3 million, nearly six times the capital sum voted for street lighting during that financial year.

It has been proved that the reduction of accidents is directly related to the level of the average road luminance.<sup>(2)</sup> (20–30% lower for roads with a level of 1.2 to 2.0 cd/m<sup>2</sup> compared with lower levels of 0.3 to 1.2 cd/m<sup>2</sup>) and therefore considerably greater savings in financial terms could have been made if the many kilometres of Johannesburg roads which are still underlit obsolete lighting equipment were provided with a better standard of lighting. Such conclusions could, no doubt, be applicable to any other town or city in the Republic.

These statistics reflect the financial aspect only without any account being taken of the reduction in human suffering and misery which is the inevitable result of fewer and less serious accidents.

In the recent study which gave us the data on the effect of lighting intensities on accidents referred to above, it was interesting to see that surround luminance, or the level of lighting on the backgrounds to the roadways, also had a significant influence on the accident rate. The importance of this conclusion must surely negate the usage of the term "road lighting" instead of the older more correct term of street lighting. Another factor which was shown to have an influence on accidents is the uniformity of road surface luminance although this had by no means the same weighting. Reduction of glare appeared to have less influence but, like the other factors, several of which are interdependent when making such evaluations, further study of the results is still needed to give a true judgement of each specific effect. These findings will again be referred to at a later stage in this paper.

In the same way that the provision of lighting will have a marked effect on the reduction of accidents,

the removal or lowering of standards of lighting will lead to an increase in accidents.<sup>(1)</sup> This was very well illustrated in the United Kingdom in 1973/74 when, because of fuel shortages, cuts in street lighting were ordered by the Government. A report to Members of Parliament at the House of Commons showed that the 50% cut in street lighting resulted in an immediate 12% increase in fatalities and serious road accidents during the hours of darkness despite a 10% decrease in vehicle usage. The estimated cost to the public of these additional deaths and serious accidents was R10,8 million, far more than the cost of energy saved.

A report compiled by the Greater London Road Safety Unit in conjunction with the police and other bodies stated that if the cuts had not been withdrawn an additional 900 pedestrian accidents and 65 fatalities would have been expected in London alone during that period.

Those who advocate reducing standards of street lighting in South Africa either by lowering lighting levels, reducing the number of lamps per kilometre of road or by switching off the lighting to shed load, must realise they are affecting human safety and increasing the financial burden on the man in the street.

## 1.2 Personal Safety

The other reason for the provision of street lighting, safety of person and property, has not been as closely researched as has the aspect of traffic accidents. The main reason for this is the difficulty of obtaining reliable data. Assaults, vandalism, rape, robbery, handbag snatching, thefts from cars or property are unfortunate aspects of modern life which we have to live with and do not always report to the police.

The only known investigation in South Africa into the effects of lighting and crime was reported in a paper to SANCI some years ago by Brig. C. von Keyserlingk. In his paper, he noted that there was an increase of 190% in crime in streets with poor lighting compared with those where good lighting was installed and the rate increases to 250% in streets where there was no lighting.

In a recent investigation into a large number of reports on crime and lighting and the effects of lighting on a number of target areas in the United States of America<sup>(2)</sup> the answers obtained are admittedly statistically inconclusive. Nevertheless survey data revealed that from 14 to 52 per cent of respondents reported going out more at night following the installation of street lights and some said that street lights helped them to observe and report crimes in progress to the police.

Virtually all the police officers questioned reported that in an area where new street lighting had been installed their reaction time improved as well as their ability to cover fellow officers at distances from them and identification and apprehension of suspects was greatly facilitated.

In Johannesburg a decision was made some years ago when most of the reticulation was done by overhead cables that, in residential areas, lights would be installed only on alternate poles, which meant an effective spacing of 75 m. The same policy is rigidly adhered to today with poles being spaced 70 m apart in these areas, with few exceptions being granted. The number of requests and, in some cases, even demands from residents for the installation of a light on the intermediate pole or for a light to be installed at a point between two cable-fed poles would fill a book. The common reasons given for the requests are that in the darker areas where their homes are situated there is an increase in thefts of fuel and components from parked cars, there is a congregation of undesirable elements in the dark areas, which leads to attacks on people walking in the streets, and that their homes are broken into more frequently than those near a street light.

Whatever the statistical data, there is obviously a very strong feeling that lighting is a deterrent against crime and that it decreases the fear of crime. There was further evidence of this at the time of the Soweto disturbances in 1976 when then, and ever since, the demand for lighting has substantially increased. Residents who traditionally refused to have lighting installed in their suburbs came demanding it and many are the enquiries received from would-be plot or house buyers in suburbs without lighting seeking assurance that lighting will be installed in the near future. It is also a fact that those who derided the installation of street lighting are now amongst the quickest to report when a light goes out. In areas of higher living densities there is always the fear for children having to walk home from school or recreation activities during the darker winter evenings. In the Johannesburg Hillbrow and Berea areas which have some of the highest population densities in the southern hemisphere, the unit service and sanitary lanes are such a source of complaint that a strong effort is now being made to light these lanes to reduce the incidences of crime and unhealthy activities which abound in them every night.

The switching off of street lighting certainly has an effect on crime, as was again amply illustrated in Britain during the 1973/74 blackouts.<sup>(3)</sup> The Sussex police reported a 100% increase in burglary offences and a 59% increase in thefts from unattended vehicles. Preston reported a 65% increase in house-breaking, 66% in shopbreaking, 25% in theft from persons and 65% in thefts from shops and stalls. Anxiety levels amongst the public increased dramatically as was confirmed in the Boroughs of Bramley and Kedbridge when complaints during the first three months rose by more than 2 000 in each Borough. The cost of handling these complaints was estimated at R18 000 which swallowed up a large proportion of the savings in energy costs which the authorities hoped to achieve.

Finally any suggestion that a city in these days must be prepared to black out the lighting in a state of emergency or war must be emphatically rejected. Enquiries confirm that aircraft have enough sophisticated equipment available today to enable them to seek out a target without any visual aid. Switching off street lighting would only result in increase panic by the public, considerably reduced mobility of emergency vehicles and personnel as well as providing an open invitation for local terrorism.

## 2. Standards of Lighting

Having established that street lighting is an essential public service which cannot morally be denied to any ratepayer, it is important to investigate what levels should be provided. The South African Bureau of Standards makes certain recommendations in their code of practice for street lighting, which was based on the old CIE recommendations but downgraded by 25% on the insistence of some representatives of public authorities. Are these standards still valid today, some 14 years later?

As far as motorways and arterial roads are concerned the introduction of lower speed limits to conserve fuel has, in all probability, not altered the requirements specified. In Europe where, to take an example, a minimum road luminance of 2 cd/m<sup>2</sup> is specified for motorways and important heavy and high speed highways<sup>(4)</sup> the equivalent standard, in this country is 1,5 cd/m<sup>2</sup>. This difference may possibly be justified at this point in time by our lower speed limits, but would need to be reconsidered if speed restrictions were ever to be lifted.

### 2.1 Residential Streets

There has been much debate regarding the lighting of Class B roads, i.e. those in residential and industrial areas where the roads cater essentially for local traffic. The problem, particularly in townships with the traditional grid layout of streets, is to define accurately which road is a through road and which caters for local residents only. Recognising this, the CIE Road Lighting Committee, TC - 4.6 decided at

its meeting in Warsaw in 1980 to form a new subcommittee under the chairmanship of the Author to investigate and report on the lighting of roads not covered in the CIE document 12/2, which will include these Class B designated roads. The work of this subcommittee is still in its very early stages and firm recommendations cannot therefore be given at this point in time. However, some investigations can possibly point the way to making a few proposals. Provided that the roads do not carry any appreciable through traffic and are intended for the use of the local residents and their visitors, the method of specifying road luminance as the main criterion is difficult to justify. Instead we need to consider the street in its entirety: pedestrians, cyclists, irregularities in road and pavement surfaces, presence of animals, visual orientation, identification of persons, pleasantness of the environment, etc.

It has been suggested (6) that the horizontal illuminance on the pavements in this area of lighting be not less than 0.2 lux and on the carriageway not less than 1 lux with a minimum to maximum uniformity ratio equal to or better than 1:40. The value of 0.2 lux has been based on extensive investigations into the minimum lighting level to evacuate buildings in time of emergency. It is proposed that this same level be provided as a minimum for pedestrians with the higher value of 1 lux being provided for the comparatively greater vehicle speed on the roadway. If positive identification of persons is required, and this may perhaps be more applicable in streets which are pedestrian orientated, another measure, semi-cylindrical illuminance, should be applied. This concept of semi-cylindrical illuminance in street lighting design is new and has been proposed as a measure of "pleasantness" for the environment which will also provide for good recognition of people.

Three forms of lighting measurements were considered in order to ascertain the best method for the recognition of faces:

- (a) vertical illuminance (the lighting level on a vertical plane at face level).
- (b) hemispherical illuminance (the average illuminance on a hemisphere with incident light from all directions onto the hemisphere).
- (c) semi-cylindrical illuminance (the average illuminance over half a cylinder with light coming from or above the horizontal).

After many experiments the principle of semi-cylindrical illuminance was suggested as it gave the best correlation between the amount and quality of light needed to recognise a face at the distance at which identification was considered to be important. Figure 1 shows this relationship of distance and semi-cylindrical illuminance for installations without glare (shown by means of crosses and a solid line) and with some glare (black dots and dotted line). It will be noted that two recognition distances are emphasised, one at 4 m and the other at 10 m. These distances were based on work carried out by Hall, an American anthropologist,<sup>(7)</sup> who carried out experiments on the social attitudes of people to each other in varying zones of proximity. At 10 m recognition of the fact that there is a person in your proximity is all that is necessary. As people approach each other identification of posture and face become increasingly important in order to determine the attitude of the other person: indifferent? friendly? suspect? hostile? At 4 m this attitude must be positively discernible as this is the minimum distance at which there is still time for a person to take evasive or defensive action.

To achieve this recognition it is necessary to provide a semi-cylindrical illuminance at an average head height of 1.5 m of not less than 0.8 lux anywhere in the street. For those who enjoy the mathematical exercise, calculations can be made with selected luminaires to ascertain the optimum spacings and mounting heights to achieve this value. For the others some simple parameters can be given if the luminaires

chosen meet certain minimum requirements. For post top mounted luminaires these should be:

- (a) a luminaire total light output of not less than 4 000 lumens.
- (b) the peak intensity of the light distribution should not be less than 85cd/km at an angle between 70° and 80° from the downward vertical.

The light output requirement will dictate a 70 W high pressure sodium or 125 W high pressure mercury lamp in a luminaire with a minimum light output ratio of 75%.

With this type of luminaire mounting heights should be in the order of 0.6 times the road width if they are installed on both sides of the road in opposite or staggered formation. For single side lighting it would be necessary to increase the mounting height to equal the road width. With a staggered lighting arrangement spacings between poles on the same side of the road should not exceed 50 m (i.e. 25 m spacings between consecutive poles on alternate sides of the road) and with single side mounting the maximum spacing would be 40 m. The presence of trees on the pavements could dictate closer spacings.

In order to provide some lighting quality and attractiveness to the areas, modelling and glare control need to be considered. Modelling can be defined as the ratio of vertical to semi-cylindrical illuminance and a value of between 0.8 and 1.3 should be aimed at. Lower values give a harsh appearance whereas higher values, up to 1.57 (7T/2), mean flat and dull lighting. Glare would be dependent on the design of the luminaire and its mounting height. In the design the relationship between the luminance (L) and the area (A) of the face of the luminaire can be calculated. The following maximum values have been proposed.<sup>(8)</sup>

For mounting heights lower than 4.5 m, Luminance x Area<sup>0.25</sup> < 1 250

For mounting heights between 4.5 m and 6 m, Luminance x Area<sup>0.25</sup> < 1 500

For mounting heights greater than 6 m, Luminance x Area<sup>0.25</sup> < 2 000

The luminaire manufacturer will be able to advise on these aspects. On the remainder of the Class B roads with greater vehicle traffic i.e. those roads which make up the bulk of all road lighting in a town or city, the SABS Code of Practice 098 specifies a minimum road luminance of 0.25 cd/m<sup>2</sup> with a maximum diversity of 6:1. As stated previously road luminance should not be the sole criterion for these streets where we need to provide lighting for personal and property protection just as much as for the prevention of accidents. As traffic on these roads generally travels at comparatively low speeds, glare is not the problem for drivers which it may be on a main road and therefore far greater freedom can be allowed in the choice and design of the luminaires. Perhaps it is the peculiarly prevalent problem of some manufacturers and users trying to light these roads with cut-off light distributions that makes the SABS requirements appear to be too stringent.

The present SABS specification can perhaps be relaxed, but do not let us delude ourselves that some elementary form of lighting, such as a light at every corner, is acceptable. For protection, safety and that "sense of security" it is important to avoid dark areas in a street. It is precisely in these areas where it is most likely that vehicles will be broken into or parts stolen from them, servants or children molested, property stolen from gardens and homes, or a child or pet involved in an accident.

So what is the practical standard we require? If we look at the proposal made of a minimum of 1 lux on the roadway, 0.2 lux on the pavement and a uniformity ratio not less than 1:40 what are the lighting requirements?

Taking a typical refractor bowl type of luminaire — a common semi to non-cut-off unit already used in large quantities in this country — and installing this



at a mounting height of between 6 and 8 m we can calculate that with a 125 W mercury (or 70 W HP sodium) lamp our lighting requirements can be met with a spacing to mounting height ratio of about 6:1. In other words, if we install these luminaires at a height of 8 m and at a spacing of 50 m we will, on a road width of 7 m and pavement widths of 2 m, achieve an average level of illumination of 2,38 lux on the roadway with a minimum of 0,8 lux and an average of 2 lux on the pavement with a minimum of 0,2 lux. The uniformity ratio is 1:18 on the road and 1:35 overall. (Note: The present SABS recommendation for a medium road surface is a minimum average of 2,5, 3,25 or 4,5 lux dependent on luminaire distribution). Apart from a very small area at the mid-point between the poles on the opposite sides of the road, the lighting layout will comply with the suggested standard. The low point could probably be eliminated by a slight tilting of the luminaire, longer overhang or improved refractor design.

It should be stressed that these are absolute minimum recommendations and at no time can lower standards be justified under any circumstances.

## 2.2 Major Routes

The SABS code recommends certain criteria for main roads and motorways and gives recommended methods of achieving these. There have been numerous complaints at AMEU meetings and elsewhere that the Code "is too complicated to apply", "too difficult to handle", "... considerable number of time-consuming calculations..." (vide AMEU Convention and Technical Meetings 1976, 1977 and 1978, et al). Be this as it may, and it is frankly difficult to believe that an engineer finds comparatively straightforward calculations difficult, the SABS Code is, generally, not applied. Codes in use in many countries provide tabular data from which spacings, mounting heights, etc. can be easily read and these are widely used, not always however with the success desired. Perhaps one problem with tabulated data lies with trying to group all luminaires into three types: cut-off, semi-cut-off and non-cut-off, and this is also partially applicable to our own code. In an investigation<sup>(\*)</sup> it was found that different luminaires belonging to one type provided widely varying results even when used on the same road surface.

It was also shown that if the classifications of the luminaires into these types had been ignored and lighting designed according to the light distribution from the luminaire, spacings in some instances could have been increased without reduction in the overall quality of the installation. Furthermore some luminaires whose light distribution pattern could not be related to any one of the specified types could provide even more economical installations.

Perhaps this grouping of luminaires and specifying the light distributions of each type is an inhibiting factor for our designers who would otherwise attempt to achieve more efficient and effective equipment.

The requirements for good main road lighting are still an adequate road surface luminance, reasonably good uniformity and curtailment of disability and discomfort glare. Let us briefly consider each of these aspects.

**Luminance:** The luminance, or brightness, of a road surface is dependent on two factors, the light reflecting properties of the surface itself and the light distribution from the luminaire. For over three years now the National Institute for Transport and Road Research of the CSIR has intermittently been striving to measure and correlate the reflective properties of South African roads. The AMEU, SANCI and ILESA have all contributed towards the cost of this work and it is now reaching the stage when we should shortly be getting the results. It is hoped that, as in other parts of the world, the greater majority of our roads can be classified in one or, at the most, two groups. We will then have the basic ingredient for proper lighting design. As far as luminaire design

is concerned, if the light distribution constraints of the SABS Code on the peak angle and intensities at 80° and 90° from the downward were to be scrapped or modified, manufacturers could be encouraged to develop more effective designs.

**Uniformity:** Dark patches on a roadway can lead to loss of perceptibility and the luminance should therefore be as uniform as possible. The CIE (5) (9) recommends that the overall uniformity ratio should not be less than 0,4 and the lengthwise uniformity on motorways and main arterial routes not less than 0,7 and on other roads 0,5. This is a product of luminaire design, the road surface and the geometry (spacing, mounting height, etc.) of the installation.

The SABS Code recommends that, to overcome the difficulties of calculating road luminance, a conversion factor be used to change the recommended luminance value given to values of illuminance (or illumination levels). In the same way the maximum luminance uniformity ratio is changed to ratios of illumination levels and, it is said, if certain parameters are controlled the illumination uniformity ratio can be 1,5 times greater than that given for luminance and a satisfactory installation will normally result. This is not generally true, as much will depend on the road surface, e.g. the smoother the road surface the higher the lighting level needed under the luminaire compared with that at remote points. Furthermore, in our code, no statement is made as to where the high and low points should occur on the road surface. As Waldram has pointed out<sup>(\*)</sup> a dark region near the kerbs may lead to failure of peripheral detection (a critical aspect of the visual mechanism of drivers) and so to an accident. This is therefore an aspect which requires our further study.

**Glare:** Glare can either impair the vision or cause discomfort to drivers of vehicles. High values can cause a reduction in visibility and will create accident conditions. Disability glare, which is expressed as the relative Threshold Increment (TI) is a product of the veiling luminance and the average road surface luminance and must be controlled to values below 10 for major routes and 20 for other roads.<sup>(13)</sup> Discomfort glare, which is far more likely to be encountered, is a product of the light distribution characteristics of a luminaire, known as the specific luminaire index (SLI), the average road surface luminance, the mounting height and the number of luminaires per kilometre. The CIE lays down limits varying between 4 and 6 as maxima depending on the road classification. These values are probably too stringent as it has been indicated that few countries adhere to them<sup>(14)</sup> and they could therefore be relaxed in practice to make them more acceptable.

It will be noted that luminaire design is one of the most important factors in good road lighting design and the manufacturer must design a unit which will satisfy all criteria and not any one in isolation. Greater freedom from prescribed limits would help him to achieve the best results. The user must also be aware of the importance of each aspect of lighting design and engineer his installations accordingly.

## 3. Designing the Installation

The only perfect way to design a road lighting installation is by a computer which can accurately apply all the many factors involved to achieve the most satisfactory and economical solution. However, few users have these facilities and they do not always wish to be bound to equipment manufacturers for their lighting designs. In practice a more concise and simpler method is needed to give results which will be reasonably accurate.

The present SABS method of converting luminance to illuminance via a road reflection factor is one answer, but this has already been decried by many users. Its accuracy is also debatable as the surfaces are not defined and reliance is put on matching photographic prints to actual surfaces.

At the other extreme is the use of the tabular "recipe" method which, as was mentioned earlier, is also inaccurate and can only be regarded as a quick elementary guide.

A few manufacturers have produced "Luminance Performance Sheets" for each of their luminaires which certainly provide accurate data for lighting design. A separate sheet must however be produced for each specific road cross-section, lighting arrangement, luminaire/lamp combination and at least two mounting heights. This could end up with a manufacturer having to print up to 30 separate sheets for each luminaire and, admirable as this may be, would be prohibitively expensive in the comparatively limited market of this country.

A suggestion to produce "luminance yield co-efficients" for luminaires which are related to the light distribution from the luminaire, the category of road surface, the effective road width and the lighting arrangement is at present being studied overseas. This is in effect a condensed form of the "Performance Sheet" mentioned above and would be far more practical and economical to produce. The luminance yield co-efficient (LYC) could then be used in the following simple formula to give the required spacing:

$LYC \times \text{lamp flux} \times \text{maintenance factor}$

Spacing = Average road luminance  $\times$  effective road width  
The remaining criteria for good lighting could then be calculated follows:

Uniformity: This could be based on a simple table which would give maximum spacing/mounting height ratios for a limited range of road widths, ALTERNATIVELY an iso-luminance diagram could be produced for a typical South African road surface. In the latter form, relative positions of high and low points could be studied.

Glare: The manufacturer would provide a "Specific Luminaire Index" (SLI) for his luminaire which would be used in the following modified CIE formula to calculate the glare mark (G):

$$G = SLI + \log L + 4 \log h' - 1,5 \log p$$

where L = average road luminance (cd/m<sup>2</sup>)

$h'$  = vertical distance between eye level and luminaire (i.e. mounting height - 1,5 m)  
 $p$  = number of luminaires per kilometre

ALTERNATIVELY a simple nomogram has been developed by the CIE to give the glare mark with the SLI as a base.

Background Lighting: As this has an important effect on accident rates (2) and on the safety of pedestrians, the CIE has proposed that the illuminance on the pavements should not be less than 0,5 times the level on the adjacent 5 m of roadway. Luminaire distribution can be designed accordingly.

The above design method is a proposal for the basis of an amended Code of Practice for the lighting of roads in South Africa. It will follow CIE recommendations as it is based on all the data published by this organisation. Individual designers will not have to "study and apply all the CIE technical reports" (ref AMEU 1978) but merely apply the four comparatively simple steps given above to achieve a good and economical installation. It is also unlikely that the data to be supplied by the manufacturer would cost much more than that which he is required to provide at the moment. Finally it is doubtful that a well designed lighting installation will cost a local authority more to install - it would probably cost less and would save the community considerable sums of money in reduced accidents and violations against persons and property.

#### 4. Conclusion

The Working Subcommittee for Roads constituted by the NBRI to establish norms for township services as recommended by the Fouche Commission has expressed concern that the standards of road lighting in South Africa are inadequate and that they vary considerably between towns. This can be confirmed from returns to a questionnaire sent to all major authorities a couple of years ago, and from investigations carried out by the CSIR (12)

which revealed the following for the 20 largest municipalities in South Africa:

- (a) the lighting load per km of road varied from 1,2 to 5,3 kW
- (b) the percentage of money spent on street lighting compared with the total spent on road construction varied from 3,3% to 14,2%
- (c) the streetlighting expenditure per inhabitant varied from R1,30 to R8,30
- (d) the cost of streetlighting per km of road varied from R253 to R1 642.

It would be dangerous to draw any definite conclusions from these data due to large variances in costing structures, but there is a strong indication of how much standards do differ between the various authorities.

What is now obviously needed is an immediate reconsideration and revision of the present SABS Code to make it more relevant to conditions today and to make it relatively simple to apply to achieve acceptable and consistent results. It has been said that the SABS will not consider undertaking this until it can be proven that a larger number of users are using the present code. Perhaps this needs to be orientated the other way - if a more practical code were to be published more people would use it. The continued debate on this subject at the AMEU and SANCI meetings shows that a revised code is necessary and that in the present developing economy it is needed urgently.

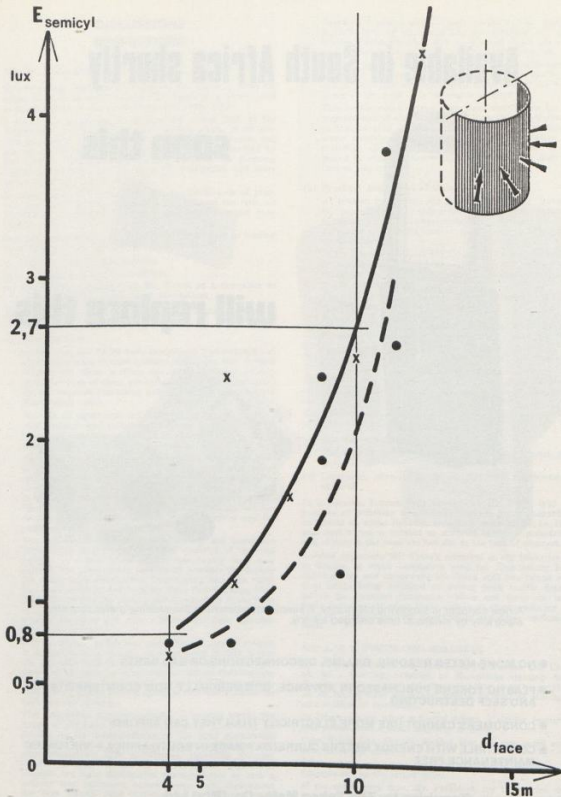
In the discussion on a paper<sup>(13)</sup> presented at the AMEU Convention in May 1976, Mr. D. H. Fraser stated that he had "queries put to us as municipal engineers regarding the justification for lighting roads at all . . . and factors taken into account in determining the luminance levels that are adopted with the various classes of roadways". It is hoped that this paper has gone some way to answer those queries and that it will possibly be the incentive for all authorities to take a new look at their present design practices to ensure that they really are providing their ratepayers with value for money.

#### Acknowledgements

The Author would like to thank the President of the AMEU for inviting him to present this paper and also to record his thanks to the City Electrical Engineer, Johannesburg, for granting permission for its presentation at the 1981 Convention.

#### REFERENCES

1. Yates R. S. - "Borrowing the Night" - Paper presented at SANCI Conference 1974.
2. Hargraves R. A. and Scott P. P. - "Measurements of Road Lighting and Accidents - The Results" - Public Lighting, December 1979.
3. "Public Lighting - The Case Against Cuts" - A statement published by the Association of Public Lighting Engineers and presented to British Members of Parliament at the House of Commons, 28 July 1976.
4. Tien J. M. - "Lighting's Impact on Crime" - Lighting Design and Application, December 1979.
5. CIE - Recommendations for the Lighting of Roads for Motorized Traffic, Publication No. 12/2, 1977.
6. Caminada J. F. and von Bommel W. J. M. - "Residential Area Lighting" - publication by N.V. Philips Gloeilampenfabrieken.
7. Hall E. T. - "The Hidden Dimension" Anchor Books 1966, Doubleday and Co., Inc., New York.
8. Braun A. G., et al - "The Optimum Utilisation of Light and Energy in Public Lighting" - Public Lighting No. 167, Volume 39, December 1974.
9. Waldram J. M. - Letter to "Lighting Research and Technology" Vol. 12, No. 2, 1980.
10. CIE, Glare and Uniformity in Road Lighting Installations, Publication No. 31, 1976.
11. CIE and APLE International Symposium, Manchester 1979.
12. de Hollain D. - "An Estimate of South African Municipal Road Expenditure and Kilometre Network" - NITR Technical Report RT/62/79.
13. Hartill P. - "The Practical Application of CIE 12/2" - AMEU Convention Proceedings 1976.



**Fig 1 Facial Recognition Distance versus Illuminance (at face height)**

(with acknowledgements to Caminada and van Bommel)

# Available in South Africa shortly

## soon this



## will replace this



A new concept in supplying electricity. A simple attachment to the existing meter provides electricity by means of time charged tokens.

- \* NO MORE METER READING, BILLING, DISCONNECTIONS OR BAD DEBTS
- \* PLASTIC TOKENS PURCHASED IN ADVANCE, COMMERCIALY NON COUNTERFEITABLE AND SELF DESTROYING
- \* CONSUMERS CANNOT USE MORE ELECTRICITY THAN THEY CAN AFFORD
- \* COMPATIBLE WITH ENERGY METERS CURRENTLY MADE IN SOUTH AFRICA — VIRTUALLY MAINTENANCE FREE

**Enquiries to: The Token Meter Co. (Pty) Ltd  
P.O. Box 1172, Pietermaritzburg 3200**

A member of the OAK Group of Companies

## DISCUSSIONS BESPREKINGS

### MR. W. WILMANS: AFFILIATE

Mr. President, Ladies and Gentlemen, Mr. Yates, it gives me great pleasure in congratulating Mr. Yates on a very topical paper delivered in his usual fluent and lively style.

I would like to second his request for a new look at the SABS code of practice for public lighting which, in its present form, does not lend itself to its full implementation but, due to results obtained from an investigation sponsored by the AMEU, SANCI, ILESA, on road surfaces, the guessing factor can now be removed from the calculation and more accurate results can be obtained.

We must however bear in mind that the SABS code of practice has served us well in the past and, without the code, no uniformity of lighting throughout the country would have been possible.

Some of the reasons given by municipal engineers as leading to problems in the practical use of the code are:

- Classification of road surfaces
- Availability of luminance meters
- Availability, as stated by Mr. Yates, of a computer to do the necessary complicated calculations

Some features to promote the practical implementation of the code are:

#### (a) Road Surfaces

In the code, the SABS have reproduced 3 photographs of different grades of road surfaces, which are then further divided into light, medium and dark. A factor is then given for each of these groupings which, when multiplied by the required luminance value, will give the required illumination value.

We will all agree that the matching of one of the roadway surfaces and textures illustrated in the Code with the actual roadway surface to be illuminated can, where done by different people, vary widely.

As we know, road surfaces do not have clear reflection characteristics and there can be areas of diffuse or specular nature. Road surfaces create mixed reflections, consisting of more or less specular components according to the conditions of the surface — rough, smooth or wet. Therefore, luminance — the visible brightness impression — depends on the location of the observer and the angle of light.

The dependence of luminance efficiency and luminance distribution on the road or on the condition of the road surface is a fact which so far has hardly been considered. The lamp socket adjustment provides the facility for wider light distribution. Calculations based on varying road surfaces and varying light distributions, however, proved that the visual quality, especially in the form of longitudinal uniformity, with a surface gradually becoming smoother and with a wide-angle light distribution, deteriorated.

Due to design, production and financial considerations, it is necessary to include an adjustment facility within the specular reflector system, permitting various light distribution types, i.e. from wide to narrow distributions. This facility can, for instance, be provided by an adjustable section within an oval specular reflector suitable for high-pressure lamps.

This adjustable specular reflector is located within the range of the light focal point and bears a deciding influence on the characteristics of the light distribution curve. The normal position of the reflector system supplies broad-beam light distribution, providing optimum results for rough to smooth road surfaces. Adjustment changes the light distribution characteristics in such a manner that optimum narrow beam light distribution for very smooth road surfaces can be achieved. It is therefore possible to adapt a luminaire to prevailing conditions of road surface. The specular reflector system was developed from calculations for achieving good illumination quality (level and distribution) in both cases.

Based on intensive tests, it was established that approximately 10% of all roads can be classified as "very smooth" (classification R5) in Europe. With an ever growing traffic density this road ratio will increase.

For this type of road, a wide-angle light distribution is no longer suitable, i.e. the required lighting quality — and in particular the longitudinal uniformity of the luminance on the road — is no longer achieved.

This now requires narrow beam light distribution for the improvement of visual conditions. By a simple adjustment of the movable specular centre piece, an adaptation is easily possible. According to the road classification the reflector, either prior to or during installation, is adjusted to wide or narrow beam light intensity distribution as required.

#### (b) Practical Assessment of Glare

At present luminaires are classified as either "cut-off" or "non cut-off". As this criteria of luminaire design is basically for glare control, municipal engineers and manufacturers are restricted in purchasing or offering a specified design.

In the latest publication of CIE No. 31 TC 4.6, discomfort from glare is described by a glare control mark which expresses, on an ordinary scale, the subjective appraisal of the degree of discomfort experienced.

The value of G associated with the different sensations is as follows:

- G1 = unbearable glare
- G3 = disturbing glare
- G5 = admissible glare
- G7 = satisfactory glare

The advantage of this system is greater freedom in the design of luminaires. Glare is dependent not only on the luminaire, but on the complete geometry of the installation.

The following information is required from the manufacturer to enable calculations to be made:—

- Specific lantern index
- The flashed area in metres squared of the lantern projected in 76°
- Luminance intensity of 80° and 88° from the downward vertical.

In conclusion, I must fully agree with Mr. Yates that the practice of switching of alternate lights is just as hazardous as having no street lighting, because a zebra effect, i.e. light and dark zones, is created as a result of which pedestrians and objects in the road are lost due to the lack of contrast.

I would appreciate Mr. Yates's comment on the latest trends in Europe in which luminaires used for illuminating busy thoroughfares and motorways are fitted with two lamps with both lamps being switched on during peak traffic density giving the required luminance values and then one lamp being switched off after 10/11 o'clock at night, reducing the level of illumination but maintaining the same uniformity ratio.

### MR. A. H. L. FORTMANN: BOKSBURG

Mr. President, Ladies and Gentlemen, the Durban City Council, at a meeting, resolved to discontinue lighting Snell Parade, while no road and street lighting is to be provided on all future main roads and streets, as well as streets in new residential townships.

In Johannesburg, after a heated debate, a similar resolution was passed with a small majority of votes.

Cape Town City Council decided that all new main roads were to be left unlit.

Other cities and towns in South Africa are following the example set by the larger cities.

If the above were true, Mr. President, try to imagine what the street in front of this hotel would be like with no lighting. Try to imagine what our cities and towns would be like with no street lighting — dark and eerie streets. Just imagine what would happen to the accident rate of motorists, the safety of persons and the security of private property.

In his opening address to this paper, Mr. Yates stated that the lighting of streets and highways was probably one of the most controversial and emotive aspects of municipal electricity undertakings.

This statement is, of course, very true — but it is a great pity that this should be so.

If we ponder what it would be like to live in cities and towns with no lighting at all, I am sure we will all agree it would be dreadful.

This, however, is the extreme bleak end of the scale.

If, on the other hand, lighting should be provided, and I dare say that not one councillor or engineer present here today would want it any other way, then surely lighting might as well be done properly.

Well-lit roads and streets are undeniably a pleasure to the eye, besides the many advantages which Mr. Yates has already highlighted in his address.

We have SANCİ in this country continually engaged in promoting lighting in all its spheres with road and street lighting featuring in particular for AMEU members and here I would appeal to non-members of SANCİ to seriously consider becoming members, because of the considerable benefits to be gained.

If the city or town electrical engineer is unable, because of other commitments, to attend SANCİ congresses in person, then some other person in his department involved in the design of road and street lighting, could be delegated to attend to the benefit of that Council.

Once we are aware of the significance of good lighting, then the acknowledgement of the need for good lighting, as well as for designing on a more scientific basis, will almost certainly follow automatically.

Turning to the paper, could Mr. Yates please clarify the third paragraph on page 3 in which he describes the findings on a recent study on the effect of lighting intensities on road accidents and surround luminance and the conclusion reached regarding the terminology, road lighting versus street lighting.

In the final paragraph of section 1.2, viz., the third paragraph on page 6, Mr. Yates briefly discusses street lighting in a war situation. To this paragraph could be added the fact that street lighting would benefit civil defence teams enormously in an emergency situation.

Mr. Yates, could you please explain the first few paragraphs on page 8, dealing with the new concept of semi-cylindrical illumination.

Looking at Mr. Yates' proposals regarding practical standards, my comment is that these "absolute minimum" recommendations appear to be worthwhile pursuing.

It would be interesting to hear what the SABS feel about this.

Meneer die President, die VMEQ kan dankbaar wees dat daar persone soos mnr. Yates in Plaaslike Bestuur werksaam is en graag wil ek mnr. Robbie Yates gelukwens met 'n baie insiggewende referaat. Mnr. Yates is 'n meester op sy gebied en die VMEQ-lede kan gerus goed ag slaan op wat hy hier te sê het, asook op die voorstelle wat gemaak is.

Raadslede hier teenwoordig, sowel as Ingenieurs, kan hierdie inligting gebruik om die noodsaaklikheid van goeie straatverligting, aan dié wat geneig is om hierdie aspek van dienste in 'n Plaaslike Bestuur laaste op die voorkeurlyk te plaas, te laat besef.

Ten slotte, mnr. die President, is dit ook vir my 'n groot goeie om 'n moesie van dank aan mnr. Yates, vir sy waardevolle bydrae, voor te stel.

#### MR. J. T. GRUNDY, AFFILIATE

Mr. President, Mr. Yates, Gentlemen, the title of Mr. Yates' paper is "Let's be Practical" and there seems to be this argument as to whether we call it "street lighting" or "road lighting". I don't think it matters which we call it, but possibly the justification for it is that we think of a street as an urban road and we think of a road as a highway.

I think the technical justification for this, Mr. President, is that in the CIE 12/2, it is laid down that the five metres of the surrounds to any road should be illuminated to a level of 50% of the main road surface. Now I think we might throw at Mr. Yates the question "Are we talking about illumination

or are we talking about luminance." But, at any rate, so far as the lantern design is concerned, this, in effect, is what we're designing the optics of the lantern to do today.

On residential road lighting, this semi-cylindrical theory, I think, is very intriguing indeed and Mr. Yates' suggestions for this vertical and semi-cylindrical affair could, I think, be coped with by a computer program, and there should be no great difficulty in devising such a programme.

With regard to testing an installation, there is in existence a cylindrical photometer which we use for interior lighting and such a meter could easily be adapted to give what Mr. Yates requires, viz. his semi-cylindrical illumination or luminance.

Finally, I think it is worthwhile supporting Mr. Fortmann's comment. It is rather surprising that a small country like New Zealand has recently produced a Code of Practice simply based on CIE 12/2, while South Africa still continues to use the 1967 SABS code.

#### MR. A. CHALMERS: NATAL UNIVERSITY

I would like to congratulate Mr. Yates on what seems to me, as a relative outsider to the field, to be a very useful contribution to the debate on the way in which we should go about lighting our roads.

My one question relates to the road surface under wet conditions. This is something Mr. Wilmans also took up to some extent. I would like to take issue with Mr. Yates' remark that wet roads are not a problem in most of the Republic. I'm quite sure that most parts of the Republic are subject to rain at some time of the year although we have not seen much of it in this area for sometime, but I do feel that the presence of rain or a wet surface on a road does create a difficult visual situation and this does not appear to be fully catered for in the design process. Is there perhaps some way in which this can be incorporated in a more meaningful way than simply brushing it aside and saying we hope it will not occur?

My second very short question, also relating to the point that somebody else, I think, did mention, is the question of attempting to save power particularly during the early hours of the morning when the roads are practically unused. Is there no way that we could attempt to reduce the power consumption during those hours of darkness?

#### MR. J. W. SMIT: SABS

Mr. President, Gentlemen, Mr. Yates, congratulations on your very, very well presented paper. It is a very difficult subject and not easy to talk about, but you always seem to succeed in doing a lot with very little material.

Mr. President, I really came like the old gentleman Mr. Yates spoke about this morning — the old gent and his lav — to make a motion or to pass a motion and I'll be very brief to avoid "consecration".

I just want to take issue with Mr. Yates on one point. In his written paper he states that, and he quotes me really, the Bureau refuses to revise its code of practice until it has gained better acceptance. This is not true, Mr. Chairman, this is not what I said. What I said was, we would offer to make available all the necessary information to sponsors to enable Municipalities to apply CIE 12/2 and then, after it has been applied successfully, I think we would be in a much better position to rewrite our code on the basis of the experience gained and we could probably make a much better job of it. This is really what I said, Mr. Yates, I think that the way you put it is rather strong and it sounds as if we are not keen to do the job.

#### MR. J. K. VON AHLFTEN: SPRINGS

I wish to add my thanks to Robbie Yates for the interesting presentation of his paper which, no doubt, will add to the value of our proceedings.

We, as municipal electrical engineers responsible for public lighting in our towns and cities, fully subscribe to the views put forward by the author regarding the true reasons for providing lighting. The problem as I see it to date has been to get the present standards for different types of streets nationally adopted. This has not been because of a reluctance or unwillingness on the part of the municipal lighting authorities, but more a question of co-ordinating the design within

the framework of standards for and availability of lighting equipment in this country and the financial means of municipal authorities.

The NBRI Working Subcommittee for electrical distribution investigating rational norms for township services as recommended by the Fouché Commission of inquiry into housing matters has done a practical exercise and found that, on a percentage basis, the total cost to provide electrical services in an average residential township is made up as follows:—

HV distribution .....	30%
LV distribution .....	45%
Streetlighting .....	15%
Service connection .....	10%

In relation to all services, the percentages are as follows:—

Electricity .....	17%
Streetlighting .....	3%
Water .....	10%
Sewerage .....	10%
Roads and sidewalks .....	40%
Stormwater drainage .....	20%

In relation to road construction and drainage, the funds required for residential streetlighting would appear to be minimal as was pointed out by the author, but in relation to the other essential services this is by no means the case.

Much has been said at these Conventions and Technical Meetings about the application of the SABS Code for Public Lighting but I must endorse the views of the author that it can hardly be accepted that a qualified municipal electrical engineer should find the application of the Code difficult or even impossible.

It is probably more a question of co-ordinating the design, manufacture and the application of the Code, as amended from time to time to meet national and international standards, to ensure that public money is well spent.

I should therefore be emphasised that the present Code and the newly issued SABS Specification for streetlighting luminaires will go a long way in at least ensuring that streetlighting installations will comply with reasonable standards and it is up to us, the municipal electrical engineers, to see that these standards are met. We have the tools, we must just see to it that they are used.

Once again our thanks to Robbie Yates for a very frank presentation of the facts which, no doubt, will go a long way in assisting us to be practical in the provision of public lighting in general.

A final thought I wish to submit to this Convention is that more local authorities should make use of the expertise of SANCI as the national body concerned with the art, science and application of lighting. They will find the assistance so gained to be well worth the effort.

#### CLR. C. VENTER: JOHANNESBURG

Mr. President, thank you very much for the opportunity for the Councillors to defend themselves after this rather unwarranted attack on them for not wanting to spend money on street lighting.

My congratulations to Mr. Yates for his very well written paper. However, you know I am one of those horrible councillors who have to explain to the ratepayer why we have to increase his rates so that he can have more street lights and why we have no money to tar the road in front of his house. Those are factors that we must take into consideration when we talk about street lighting.

Mr. President, there was a statement made here that Johannesburg took a decision not to improve the street lighting on major roads or main roads and expressways. I do not believe that is quite true. As a matter of fact, we spend a considerable fortune on street lights on major roads and I think that we are all in agreement in the City Council of Johannesburg that we should have main roads and expressways well lit.

There is the question of lighting. I, as a member of the public, can tell you that we find some of these street lights are quite irritating. We talk a lot about the M2 and other roads in Johannesburg, but drive on one of those roads and you will find that the lighting becomes somewhat irritating — it is too much. We must be very careful that we do not overspend



Rdl. C. Venter.

on projects like that, which actually should have been done on a much lower level.

There was a question of accidents at night and during the day, but I did not see any comparison between the two. What about the accidents that happen during the day when the good Lord provides the lighting, and that is excellent lighting?

Is it not also a fact that many accidents at night are due to the fact that a very large proportion of our population is dark skinned and you cannot see them so well at night, however good the lighting.

I would like Mr. Yates to comment, too, on the question of high mast lighting. You know, when we introduced high mast lighting in Soweto we found a considerable improvement as far as the crime rate was concerned. I think it is far better than ordinary street lighting, which can actually encourage crime because you see the criminal only when he comes within the circle of light given by a given lamp, but the moment he leaves that, he is again in darkness and you cannot see him at all. The general lighting we have in Soweto gives strong light everywhere and not just in one particular place and you have far less dark areas where criminals could hide. Is that not a factor that we must give serious consideration to?

There was a question of the criminal element during the strikes in the United Kingdom in 1973. I was there at the time and it was not only the street lights that were put off, but also shopwindow lighting. They just cut the power in an entire area without warning at say six o'clock at night. It is then that you get the criminal moving in and doing what he wants to.

Then we blame lack of street lights for road accidents. Are the recklessness of drivers, the consumption of liquor and the irresponsibility of pedestrians not also major factors?

In conclusion Mr. President, I do believe that we have to provide street lighting and we have to provide reasonably good street lighting. In Johannesburg, it's our policy that in domestic areas every second pole must carry a street light, but we must accept one thing as policy and that is that expenditure must be kept within acceptable limits. Thank you.

#### MR. R. S. YATES

Mr. President, Ladies and Gentlemen, I've got a lot to answer for by the looks of it and I've got to get through it in five minutes flat so excuse me if I do happen to miss out something.

Mr. Wilmans, thanks for all the elaboration on what I said. I did not want to scare people off and try to turn this into an extremely complicated exercise of designing of street lighting. I still think that little card which I showed at the end would probably get over a lot of the problems and make it a relatively simple thing for a person to design street lighting. You mentioned the use of two lamp luminaires and

somebody else came up with the aspect of reducing light intensities after midnight. This has been tried overseas, unfortunately the lighting costs of the luminaires themselves are very much higher and maintenance becomes a bit of a problem when the two lamps in one fitting burnt at different times, so I am not very much in favour of that, but there is a new development which has fairly recently come into being and that is to dim street lighting by means of frequency control. At certain hours, by alterations to frequency, and not very big alterations at that, we can reduce both the light intensity and power consumption. Perhaps this could be fairly easy to install on the street lighting system, we have separate street lighting mains, and I think this offers prospects for the future.

Mr. Fortman spoke about all our towns without lighting. It is a horrifying thought and, funnily enough, I live in such a township. But, as a matter of interest, when I was doing that AA report one of the things I did investigate was the aspect of two towns, very close to Johannesburg, without any street lighting at all, and the night/day accident ratios between those two towns and other towns on the Reef that do have street lighting.

The night/day accident ratios in those two towns was 1.9 times higher than it is in other towns with street lighting. Perhaps Councillor Venter could look at that aspect of it too. We are never going to cut out all road accidents, that is impossible, but we can reduce them and one way is to provide visibility and if an area is dark and underlit, the accidents will go up. If a man is drunk, he probably needs even more lighting to see his way than he does at any other time.

Street lighting in war situations, or "conflict" situations I prefer to call it, is of course a benefit to civil defence. Without lighting in our streets, our civil defence would be terribly hampered and, as I mentioned in my written form of the paper, it is an open invitation to terrorism. This, I think, we must be wary of at any time, never, never, never switch off street lighting in times of emergency.

The question of semi-cylindrical illuminance is an interesting one. It really takes into account, not merely the light falling from one lantern onto a particular part, but it is a vertical half cylinder and takes into account the light coming from any fittings which donate to that semi-cylindrical area.

Instead of just buying a post-top lantern, let's have a look at what we're buying. Let us buy something that will do something for us instead of just scattering the light all over the place.

Mr. Grundy's comment on the 50% on the pavements and road surfaces of CIE is correct. They state that there should be 50% of the illuminance. I would hate to try to gauge

illuminance of pavements which can vary between grass and paving and many other surfaces. It would be an impossible condition.

To Andy Chalmers, roads under wet conditions are not a problem. I did not mean to say it in quite that sense, but we do not have the same problem for instance as they do in the Scandinavian countries where, 80% of the time, their roads are wet. They have looked at it very carefully and, as a result, they have brought out a CIE publication specifically on road lighting for wet conditions. If we have areas in this country which have a predominance of wet road surfaces at night, then the lanterns should be chosen accordingly and you can get distributions for that purpose. I wonder how many people do look at this — many just buy another street lighting lantern.

Mr. Smit, I apologise if I made the suggestion that you did not want to do anything about the Code. This was wrong of me, it was not intended that way, but I do still feel that we have to revise our code. If we start with a revision of the code now, I think we'll get a better following. Let us get it into a simpler form which the people can understand and use. Let us give them the data sheets for the lanterns and then we should get far more people following the code. May I repeat, it was never my intention to say that you were not prepared to do anything. I know you are.

Mr. Von Ahlften, thank you for your comments. To Councillor Venter, the actual level of lighting is related to the actual number of accidents. This has been recently proven in a very extensive experiment carried out over five years overseas and, to a point, will be progressively reduced as lighting is improved. If you drop the lighting levels, you are going to increase accidents.

We do not spend money on lighting where it is not necessary, nor do we have standards which are too high.

High mast lighting works well in a place like Soweto, where we have single storey houses. It does not work where you have large buildings and a lot of trees or other obstructions of that nature which create shadows. It was a solution for Soweto which was introduced and certainly did cut down the crime rate considerably. Thank you very much, gentlemen.

#### MR. D. H. FRASER: PRESIDENT

Thank you Mr. Yates, for handling the discussion in such an able manner. I'm sure that we all agree that this has been a most entertaining and informative paper and I have much pleasure in asking you to accept an AMEU tie which, I hope, will remind you of this occasion.

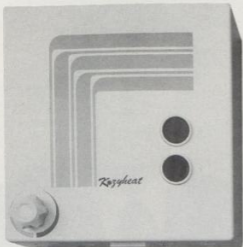
Thank you Mr. Yates.



*Afgevaardigdes luister aandagtig na 'n spreker.*



# INSTANT WATER HEATER



This unique little box  
will deliver hot water

*... instantly -  
continuously!*

## Safe

Trip free operation  
Automatic anti-scald device  
Designed to comply with S.A.B.S. draft specification

- \* Ideal for sink, shower, wash hand basin etc., in the home, factory, shop, hospital, clinic, almost every situation.
- \* The installed price in a new house or housing project is less than half of that of a conventional geyser.
- \* No standing energy losses.
- \* No noticeable load on electricity reticulation system because of diversity.
- \* 3 year guarantee backed by an international group.

---

**Enquiries to:**



**Kozyheat (Pty) Ltd**  
**P.O. Box 1172, Pietermaritzburg 3200**  
**Telephone 0331-51311**

---

A member of the OAK Group of Companies

# AN INTRODUCTION TO ENGINEERING ECONOMICS

D. C. PALSER

CITY ELECTRICAL ENGINEER  
CAPE TOWN

## MR. D. H. FRASER: PRESIDENT

Mr. Dennis Palsar, CEE of Cape Town since 1974 has contributed much to previous Conventions and Technical Meetings of the AMEU and when he volunteered to present a paper to this Convention the offer was readily accepted. It is obvious that a good deal of time and effort has gone into its preparation and I am sure that it will serve as a valuable work of reference for Municipal Electrical Engineers in the future.

Mr. Palsar graduated from the University of Cape Town in 1950 with B.Sc. degree "with distinction" in Electrical Engineering. He had the further distinction of being awarded the City of Cape Town's Gold Medal for the best final year engineering student. Dennis joined the Cape Town City Council immediately after graduation as Graduate Trainee (effectively a pupil engineer) and progressively worked his way up through the ranks to Main Engineer, Distribution Engineer, Assistant City Electrical Engineer, Deputy City Electrical Engineer and finally City Electrical Engineer in 1974. He holds the following other qualifications: Professional Engineer (Pr.Eng.), Chartered Engineer (C.Eng.), Fellow Institution of Electrical Engineers (FIEE) and at present is the Overseas Representative of the Institute in the Cape, Member SA Institute of Electrical Engineers (M(SA) IEE), Member, Institute of Certificated Mechanical & Electrical Engineers (MI Cert. MEE), Associate Member, SA Institute of Management (ASAIM).



Mr. D. C. Palsar.

## 1. INTRODUCTION

The main aim of this paper is to stimulate an increased interest in engineering economics and to engender thereby a heightened awareness of the extent, scope and potential of the various analytical techniques available as valuable aids to management in the making of investment decisions, particularly in respect of capital plant and equipment. It is not intended to be a comprehensive and all-embracing treatise but is meant merely to serve as an introduction to the subject. It is a subject, though, that is assuming increasing importance, particularly in today's inflationary environment of rapidly escalating costs and high interest rates. It is accordingly now more important than ever before that engineers, who all too often are preoccupied largely with technical matters, should take an increasing interest in engineering economics.

The subject of engineering economics is a broad one, but in essence it covers all the various principles, techniques and methods employed to assess the relative economic attractiveness of proposed alternative projects and thereby facilitate investment decisions. Such decisions invariably centre on whether or not a given capital investment is economically justifiable in the light of the expected future financial returns and possible risks and uncertainties associated with the investment. At all times it is the differences between alternatives that are important.

In this paper consideration is given to the basic principles of compounding and discounting and the application of these principles to the various discounted cash flow methods of investment appraisal, all illustrated by means of practical examples. Particular emphasis is placed on the importance of inflation and growth in economic studies. These are aspects that are usually given little attention in the literature but which nevertheless are now of considerable importance because of today's sustained high levels of inflation. Finally, although the mathematical aspects are dealt with generally, the various techniques and methods are considered largely from the municipal or public sector point of view. This approach considerably simplifies the treatment since tax considerations are not involved.

## 2. BASIC PRINCIPLES OF COMPOUNDING AND DISCOUNTING

### 2.1 General

A prerequisite to any study of engineering economics is a clear understanding and full appreciation of the basic principles of compounding and discounting. This section therefore deals with the development of the various mathematical relationships and techniques involved. At first sight some of the formulae may appear complex and somewhat daunting, but once one or two fundamental concepts are grasped, the rest should readily follow and the logical sequence and general method of approach become clear.

### 2.2 Time value of money

Underlying all compounding and discounting techniques is the fact that money has a time value. In other words, one rand today does not have the same value as one rand at some future date. The underlying reason for this is that money is not freely available and those with a surplus of money are accordingly only prepared to lend it to others requiring additional money in exchange for an assurance to repay a larger sum at some agreed future date. The difference between the sum borrowed and the larger sum repaid is the return to the lender for the use of the borrowed money and is known as interest.

Interest is usually expressed as a rate per period, the customary period being one year. For example, if R100 is borrowed today with the promise to repay a sum of R109 in a year's time, the interest rate is expressed as 9% per annum, or fractionally as 0,09.

### 2.3 Compound interest

If the interest earned is not immediately paid to the borrower as it is earned but added instead to the initial capital sum borrowed, namely the principal, at the end of each period, then interest for the succeeding period is calculated on this increased sum. In other words, interest is paid on interest. This process is known as compounding.

For example, assume R100 is borrowed at an interest rate of 9% per annum for a period of five years with interest compounded annually in arrears, that is at the end of each compounding period. The amount to be repaid at the end of this period will be R153,86. This sum is calculated as follows.

Year	Amount due beginning of year (R)	Accrued interest end of year (R)	Amount due end of year (R)
1	100,00	9,00	109,00
2	109,00	9,81	118,81
3	118,81	10,69	129,50
4	129,50	11,66	141,16
5	141,16	12,70	153,86

This compound interest series can be expressed in general terms, as follows, where P is the initial investment or principal and r is the annual interest rate expressed as a fraction.

Year	Amount due beginning of year	Accrued interest end of year	Amount due end of year
1	P	Pr	P(1+r)
2	P(1+r)	P(1+r).r	P(1+r) <sup>2</sup>
3	P(1+r) <sup>2</sup>	P(1+r) <sup>2</sup> .r	P(1+r) <sup>3</sup>
n	P(1+r) <sup>n-1</sup>	P(1+r) <sup>n-1</sup> .r	P(1+r) <sup>n</sup>

The amount to which the initial sum P will accumulate with compound interest at the rate r per annum for n years may be expressed by the symbol S. Hence,

$$S = P(1+r)^n$$

It has been assumed that the interest rate r is a rate per annum and that the period n represents the number of years. In general, though, the compounding period can be either less than or more than a year with the interest rate being expressed on a compounding basis. The symbol r is then generally the interest rate per period and n the number of compounding periods.

#### 2.4 Compounding and discounting

As shown above the amount (S) of an initial sum (P) for n periods at an interest rate r per period is given by the following expression.

$$S = P(1+r)^n$$

It is the expression which relates the future value or amount (S) to its present value (P). In other words, in the language of financial mathematics, S is the compounded value of P.

The above equation can also be rearranged as follows.

$$P = S(1+r)^{-n}$$

This alternative expression gives the present value (P) that is equivalent to a future sum or amount (S). In the language of financial mathematics P is known as the discounted value of S.

The above two equations constitute the basis of all compounding and discounting formulae and techniques on which engineering economic studies are based. It is clear that discounting is the opposite process to compounding. Compounding calculates forward in time to determine terminal values. The reverse process, discounting, calculates backwards in time to express future sums as equivalent present values.

For ease of expression and the derivation of more complex formulae, the value  $(1+r)^{-n}$  is conventionally written as  $v_{n|r}$ , that is

$$v_{n|r} = (1+r)^{-n} \quad (1)$$

This expression  $v_{n|r}$  is read as "v angle n at r" or "v, n angle r".

We therefore have

$$P = S v_{n|r} \quad (2)$$

In other words,  $v_{n|r}$  may be defined as the present value

of a future sum of one (for example, one rand) at an interest rate r per period for n periods.

At this point it should be clearly noted and remembered that v— is the expression that enables a future sum to be expressed as an equivalent present value, or vice versa. All compounding and discounting techniques are based on this equivalence.

Although values of  $v_{n|r}$  can readily be calculated, particularly by means of today's relatively cheap and compact pocket scientific calculators, financial tables are available giving the value of  $v_{n|r}$  for the usual range of

values of n and r. Calculators, however, are particularly useful in easing the labour of calculation when fractional interest rates or periods are involved, or two examples will illustrate the use of these formulae.

Example (1): To what value will R583 accumulate in 11 years at an interest rate of 8% per annum compounded annually.

$$S = \frac{P}{v_{n|r}}$$

where  $P = 583$

$$v_{n|r} = (1,08)^{-11}$$

$$= 0,42888$$

$$\therefore S = \frac{583}{0,42888} = R1\,359,35$$

Example (2): What is the present value of R2 671 due in 24 years' time at an interest rate of 8,77% per annum compounded annually.

$$P = S v_{n|r}$$

where  $S = 2\,671$

$$v_{n|r} = v_{24|8,77}$$

$$= 0,13298 \quad (\text{using a calculator})$$

$$\therefore P = 2671 \cdot 0,13298 = R355,19$$

In other words, a sum of R355,19 invested now at an interest rate of 8,77% per annum will amount to R2 671,00 in 24 years' time.

#### 2.5 Annuities

##### 2.5.1 General

Most problems in engineering economics involve one or more cash flow series, that is periodic sums either received or paid out over a period of time. For the purpose of economic comparison it is necessary to convert these cash flows to equivalent values at some common date, either the present time or some future or past date. The techniques involved will be dealt with in more detail later in the paper.

Although cash flows are generally irregular in both magnitude and time there is one special type of cash flow series that is of the utmost importance and basic to all economic study techniques, namely the constant periodic cash flow series known as an annuity.

An annuity is a series of constant periodic cash flows over a period of time. As its name implies it was originally applied to a series of equal annual payments but today the meaning has been extended to include any fixed period, either shorter or longer than a year. This fixed period is known as the payment period.

Interest is compounded at fixed time intervals known as the compounding period. The compounding period is usually one year but can also be longer or shorter than a year. Frequently this period is less than a year and compounding periods of a month, quarter or half-year are common. In the following analysis the compounding period will be assumed to be the same as, and to coincide with, the payment period. The general case will be considered in section 2.10.3.1.

The interest rate is the interest rate per compounding period. In practice, though, interest rates are generally quoted on an annual basis.

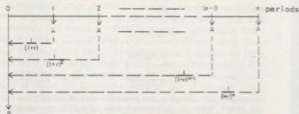
### 2.5.2 Present value of an annuity

The formulae for calculating the present value and the amount of an annuity will now be developed.

- Let  $P$  = present value of an annuity  
 $S$  = amount of an annuity  
 $A$  = constant periodic payment (assumed to arise year-end in this analysis)  
 $n$  = number of compounding periods (assumed equal to the number of payment periods in this analysis)  
 $r$  = interest rate per compounding period

The present value of the series is found by determining the present value of each periodic payment ( $A$ ) and then summing these individual present values to obtain the composite present value. The present value of each periodic payment ( $A$ ) is found by discounting it to the present to determine its equivalent present value. This process is the opposite of compounding, namely determining the future value or amount of an initial or present sum.

This series, and the discounting procedure, may be represented diagrammatically, as follows.



The present value of a future payment,  $A$ , one period away will be  $A/(1+r)$ , in the reverse direction, looking forward, this initial sum  $A/(1+r)$  at an interest rate  $r$  for one period would amount to  $A/(1+r)$ .  $(1+r) = A$ . In other words, a sum  $A/(1+r)$  now is equivalent to a sum  $A$  one compounding period hence. Or expressed in the opposite direction, a sum  $A$  arising one period hence is equivalent to a sum  $A/(1+r)$  now. It is most important to have a clear understanding of this equivalence and the reciprocal nature of compounding forward in time and discounting back in time since all compounding and discounting techniques are based on this relationship.

Similarly, it is clear that a sum  $A$  arising  $n$  compounding periods hence will be equivalent to a present value of  $A/(1+r)^n$ .

The present value of the series may now be written as the sum of the discounted values of all the periodic payments ( $A$ ) in the series, as follows.

$$P = \frac{A}{(1+r)} + \frac{A}{(1+r)^2} + \dots + \frac{A}{(1+r)^{n-1}} + \frac{A}{(1+r)^n}$$

$$= A \left[ \frac{1}{(1+r)} + \frac{1}{(1+r)^2} + \dots + \frac{1}{(1+r)^{n-1}} + \frac{1}{(1+r)^n} \right]$$

The series in the square brackets is a geometric progression and its sum may be obtained either directly from the expression for the sum of a geometric progression, or by multiplying both sides of the above equation by  $(1+r)$ , as follows.

$$(1+r)P = A \left[ 1 + \frac{1}{(1+r)} + \dots + \frac{1}{(1+r)^{n-2}} + \frac{1}{(1+r)^{n-1}} \right]$$

Subtracting the first equation from the second we obtain

$$(1+r)P - P = A \left[ 1 - \frac{1}{(1+r)^n} \right]$$

Rearranging we have

$$\frac{P}{A} = \frac{1 - (1+r)^{-n}}{r}$$

The value given by the above equation, namely the present value of an annuity of one per period (for example,

one rand per annum) for  $n$  periods at an interest rate of  $r$  per period, is conventionally represented by the symbol  $a_{\overline{n}|r}$ . This is read as "a angle  $n$  at  $r$ " or "a, n angle  $r$ ". Hence

$$a_{\overline{n}|r} = \frac{1 - (1+r)^{-n}}{r} \quad (3)$$

This is a most important equation. Values of  $a_{\overline{n}|r}$  can be determined from financial tables for the usual range of  $r$  and  $n$ . It is, however, a simple matter to compute values of  $a_{\overline{n}|r}$  directly by means of a scientific calculator.

The present value ( $P$ ) of an annuity of  $A$  per period for  $n$  periods at an interest rate  $r$  per period is given by the following general expression.

$$P = A \cdot a_{\overline{n}|r}$$

It is of interest to determine the limiting value of  $a_{\overline{n}|r}$  as  $r$  tends to zero. This limiting value of  $a_{\overline{n}|r}$  is of use in more complex formulae where composite discount rates are employed. These composite or effective discount rates are made up of a number of different individual rates. Depending upon the relative values of these individual rates the effective discount rate can either tend to or equal zero. The application of these composite effective discount rates will be considered later when developing formulae that simultaneously take account of different rates of interest, growth and inflation, for example.

From an examination of the series in square brackets above, namely the value of  $a_{\overline{n}|r}$ , it is clear that as  $r$  tends to zero the individual terms tend to unity. As there are  $n$  terms in the series the value in square brackets will clearly tend to  $n$ .

$$\therefore \lim_{r \rightarrow 0} a_{\overline{n}|r} = n \quad (5)$$

$$\therefore a_{\overline{n}|0} = n$$

Example (3): Calculate the present value of an annuity of R100 per annum for 2 years at an interest rate of 9% per annum.

$$P = A \cdot a_{\overline{n}|r}$$

where  $A = 100$

$$a_{\overline{2}|0.09} = a_{\overline{2}|9\%}$$

$$= \frac{1 - (1.09)^{-2}}{0.09}$$

$$= 9,8226$$

$$\therefore P = 100 \cdot 9,8226 = R982,26$$

(from financial tables or by means of a calculator)

Example (4): What monthly annuity can be purchased for R5 000 for 1 years at an interest rate of 8% per annum compounded monthly?

$$A = \frac{P}{a_{\overline{n}|r}} \quad (\text{by rearranging the annuity equation})$$

where  $P = 5\ 000$

$n = 120$  (number of months in 15 years)

$r = \frac{8}{12}$  (interest rate per compounding period)

$$= 0,67\%$$

$$\therefore a_{\overline{n}|r} = a_{\overline{120}|0,08}$$

$$= 104,64$$

$$\therefore A = \frac{5\ 000}{104,64} = R47,78 \text{ per month}$$

### 2.5.3 Amount of an annuity

An annuity, in addition to being expressed by its present value equivalent, can also be expressed as an equivalent future sum or terminal value. This future value, known as the amount of an annuity (S) can be derived by equating equations (2) and (4), which are both expressions for P, as follows.

$$S v_{nr} = A a_{nr}$$

$$\therefore \frac{S}{A} = \frac{a_{nr}}{v_{nr}}$$

The value given by the above equation, namely the amount of an annuity of one per period for n periods at an interest rate of r per period is conventionally represented by the symbol  $s_{nr}$ , read as s angle n at r'' or "s, n angle r."

Hence

$$s_{nr} = \frac{a_{nr}}{v_{nr}}$$

This equation can be rearranged as follows.

$$a_{nr} = s_{nr} v_{nr} \quad (6)$$

This is a most important identity.

The actual value of  $s_{nr}$  in terms of n and r can be determined by substituting the values of  $v_{nr}$  and  $a_{nr}$  from equations (1) and (3) respectively.

$$\begin{aligned} s_{nr} &= \frac{a_{nr}}{v_{nr}} \\ &= \frac{1 - (1+r)^{-n}}{r} \cdot \frac{1}{(1+r)^{-n}} \end{aligned}$$

$$\therefore s_{nr} = \frac{(1+r)^n - 1}{r} \quad (7)$$

The limiting value of  $s_{nr}$  as r tends to zero may be determined from equations (1), (5) and (6). It is evident that in the limit  $a^{n/0} = n$  and  $v^{n/0} = 1$ .

$$\therefore s_{n/0} = n \quad (8)$$

This relationship is useful in more complex formulae as will be illustrated later.

The amount (S) of an annuity of A per period is then given by the following expression.

$$S = A s_{nr} \quad (9)$$

Example (5): Calculate the amount of an annuity of R1 250 per annum for 18 years at an interest rate of 8% per annum.

$$\begin{aligned} S &= A s_{nr} \\ &= 1\,250 \cdot s_{18/8} \\ &= 1\,250 \cdot \left[ \frac{(1.08)^{18} - 1}{0.08} \right] \\ &= 1\,250 \cdot 37.4502 = R46\,812.80 \end{aligned}$$

Example (6): Calculate the amount of an annuity of R75 per month for 14 years at an interest rate of 6% per annum compounded monthly.

The number of compounding periods is  $14 \cdot 12 = 168$ .

The interest rate per compounding period is  $\frac{6}{12} = 0.5\%$

$$\begin{aligned} \therefore S &= A s_{nr} \\ &= 75 \cdot s_{168/0.5} \\ &= 75 \cdot 262.305 = R19\,672.86 \end{aligned}$$

### 2.5.4 Perpetuities

It is of interest to consider a special type of annuity, namely a perpetuity. A perpetuity is the limiting value

of an annuity as n tends to infinity. We have had

$$a_{nr} = \frac{1 - (1+r)^{-n}}{r}$$

From this equation it is clear that as n tends to infinity the value of  $a^{n/r}$  tends to  $1/r$ .

$$\lim_{n \rightarrow \infty} a_{nr} = \frac{1}{r}$$

$$\therefore \frac{a_{nr}}{v_{nr}} = \frac{1}{r} \quad (10)$$

It is also evident that the amount of an annuity  $s_{n/r}$  as n tends to infinity has no meaning since the series never terminates. Hence  $s^{n/r}$  also tends to infinity.

In practice there is generally little difference between a very long life and perpetual life. The difference is perhaps best illustrated by the following schedule, based on an assumed interest rate of 8% per annum, which schedule details the value of the annuity per period corresponding to a present value of one, namely the value of  $1/a^{n/r}$ .

n (years)	$\frac{1}{a^{n/r}}$ (%)
5	25,046
10	14,903
15	11,683
20	10,185
25	9,368
50	8,174
75	8,025
100	8,004
$\infty$	8,000

From this table it is clear that there is little difference in the value of  $1/a$  beyond about 50 years. In practice, therefore, a period of 50 years is in most cases equivalent to perpetuity, particularly when it is realised that in engineering problems estimates of interest are generally not more accurate than to one decimal place. In the above example, for instance, an increase in the interest rate from 8.0% to 8.1% (within the limits of accuracy, generally) would have the same effect as changing the period from infinity to around 45 years. Hence in most practical cases there is little point in going beyond a life of 50 years.

In engineering problems perpetuities only arise in studies involving projects with long lives, such as those encountered in civil engineering; for example, concrete bridges and dams. In electrical engineering problems perpetuities are generally of little interest.

### 2.5.5 Annuity arising less frequently than annually

A further special case of interest is where the periodic instalments of an annuity arise less frequently than annually. Assuming that the instalments arise every w years for n years, then we have the following series for the present value of this annuity,

$$\begin{aligned} \text{putting } w &= \frac{n}{m} \\ P &= A \left[ \frac{1}{(1+r)^w} + \frac{1}{(1+r)^{2w}} + \frac{1}{(1+r)^{3w}} + \dots + \frac{1}{(1+r)^{(m-1)w}} + \frac{1}{(1+r)^{mw}} \right] \\ \text{Put } (1+r)^w &= (1+r)^n \\ \text{then } P &= A \left[ \frac{1}{(1+r)^n} + \frac{1}{(1+r)^{2n}} + \frac{1}{(1+r)^{3n}} + \dots + \frac{1}{(1+r)^{(m-1)n}} + \frac{1}{(1+r)^{mn}} \right] \end{aligned}$$

The expression in the square brackets is the standard expression for the present value of an annuity of one per period over N periods at an effective discount rate, d, namely  $a^{n/d}$

$$\begin{aligned} \therefore P &= A a_{n/d} \\ \text{where } d &= (1+r)^w - 1 \\ \text{and } N &= \frac{n}{w} \end{aligned}$$

Example (7): A new motor vehicle is bought every 4 years for 20 years. Assuming an initial vehicle cost of R9 500 and constant price levels, determine the present value of this series with interest at 11% per annum.

$$\begin{aligned} A &= 9\,500 \\ r &= 0,11 \\ n &= 20 \\ w &= 4 \\ N &= \frac{20}{4} \\ &= 5 \\ d &= (1,11)^4 - 1 = 51,81\% \\ a^{n/d} &= 1,6908 \\ P &= 9\,500 \cdot 1,6908 = R16\,063 \end{aligned}$$

## 2.6 Compound interest identities

The three basic formulae developed earlier are summarised below.

$$v_{nr} = (1+r)^{-n}$$

$$a_{nr} = \frac{1 - (1+r)^{-n}}{r}$$

$$s_{nr} = \frac{(1+r)^n - 1}{r}$$

The following basic identity was also established.

$$a_{nr} = v_{nr} \cdot s_{nr}$$

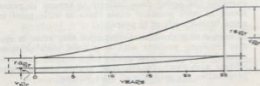
The above for equations are fundamental to all compounding and discounting techniques and are worth remembering.

Three further useful identities can be established by substituting  $v^{n/f}$  for  $(1+r)^{-n}$  in the above expressions for  $a^{n/f}$  and  $s^{n/f}$  respectively and rearranging, as follows.

$$1 = v_{nr} + r a_{nr} \quad (11)$$

$$\text{and } 1 = \frac{1}{v_{nr}} - r s_{nr} \quad (12)$$

These two relationships are depicted graphically below.



Either of the above two equations can be rearranged to obtain an expression for the interest rate  $r$ , and simplified by using the relationship  $a^{n/f} = s^{n/f} \cdot v^{n/f}$ , as follows.

$$r = \frac{1}{a_{nr}} - \frac{1}{s_{nr}} \quad (13)$$

This latter identity is also one that is worth memorising

## 2.7 Negative interest rates

Although the easiest method of determining values of the various compound interest formulae in practical problems is by means of a scientific calculator, there are occasions when it is possibly more convenient to use standard financial compound interest tables. These tables, however, are computed for positive interest rates only and accordingly cannot be used directly in calculations involving negative interest rates, such as those encountered occasionally in problems involving complex interest rates, as will be discussed later.

A method of overcoming this problem is to make an appropriate substitution that will give a positive interest rate.

$$\text{Put } (1+f) = \left(\frac{1}{1+r}\right)$$

$$\therefore r = -\left(\frac{f}{1+f}\right)$$

$$\text{Similarly, } f = -\left(\frac{r}{1+r}\right)$$

$v_{nr}$ ,  $a_{nr}$  and  $s_{nr}$

$$v_{nr} = (1+r)^{-n}$$

$$= (1+f)^n$$

$$\therefore v_{nr} = \frac{1}{v_{nf}}$$

$$\text{Next } a_{nr} = \frac{1 - (1+r)^{-n}}{r}$$

$$= \frac{1 - (1+f)^n}{-\left(\frac{f}{1+f}\right)}$$

$$= (1+f) \cdot \left[ \frac{(1+f)^n - 1}{f} \right]$$

$$\therefore a_{nr} = (1+f) a_{nf}$$

$$\text{Similarly, } s_{nr} = \frac{(1+r)^n - 1}{r}$$

$$= \frac{(1+f)^{-n} - 1}{-\left(\frac{f}{1+f}\right)}$$

$$= (1+f) \cdot \left[ \frac{1 - (1+f)^{-n}}{f} \right]$$

$$\therefore s_{nr} = (1+f) s_{nf}$$

An example will illustrate the use of these formulae.

Example (8): Determine the amount of an annuity of one for 15 years at a rate of interest of  $-10\%$  per annum (note the negative rate of interest).

$$\text{Hence } n = 15$$

$$r = -0,1$$

$$\therefore f = \frac{1}{0,9} - 1$$

$$= 0,111 \quad (11,1\%)$$

$$\text{Then } s_{nr} = (1+f) a_{nf}$$

$$= 1,111 a_{nf}$$

$$= 1,111 \cdot 7,149$$

$$= 7,943 \quad (\text{by interpolation from financial tables})$$

When using a scientific calculator the value can be computed in one step directly, as follows.

$$s_{nr} = \frac{(1+r)^n - 1}{r}$$

$$= \frac{(0,90)^{15} - 1}{-0,1}$$

$$= 7,941$$

This result is the more accurate. The value of 7 943 is less accurate since it was determined by interpolation from financial tables.

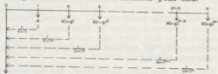
The above example illustrates the ease with which calculations can be made using a scientific calculator. Problems involving positive, negative or fractional values can readily be solved.

## 2.8 Cash flows growing at a compound rate

In today's inflationary world cash flows expressed in money times are rarely constant but increase with time. Also, in engineering problems, outputs or sales grow with time in an expanding market. In the case of municipal electricity undertakings sales of electricity increase with time, as does the corresponding income. In all cases such as these, growth is generally at a compound rate.

At this type of compound growth is frequently encountered in engineering problems an expression will be developed to calculate the present value of an annuity with the periodic cash flows growing at a compound rate of  $g$  per annum.

This type of series can be expressed diagrammatically as below for annual compounding with the cash flows arising in the conventional manner year-end.



The present value of this series,  $P$ , is given by the following expression.

$$P = \frac{A}{(1+r)} + \frac{A(1+g)}{(1+r)^2} + \frac{A(1+g)^2}{(1+r)^3} + \dots + \frac{A(1+g)^{n-1}}{(1+r)^n} + \frac{A(1+g)^n}{(1+r)^{n+1}}$$

This expression can be simplified by first multiplying both sides by  $(1+g)$ .

$$(1+g)P = \frac{A(1+g)}{(1+r)} + \frac{A(1+g)^2}{(1+r)^2} + \frac{A(1+g)^3}{(1+r)^3} + \dots + \frac{A(1+g)^n}{(1+r)^n} + \frac{A(1+g)^{n+1}}{(1+r)^{n+1}}$$

Next, put

$$(1+r) = \left(\frac{1+r}{1+g}\right) \quad (18)$$

$$\therefore (1+g)P = A \left[ \frac{1}{(1+r)} + \frac{1}{(1+r)^2} + \frac{1}{(1+r)^3} + \dots + \frac{1}{(1+r)^n} + \frac{1}{(1+r)^{n+1}} \right]$$

The expression in square brackets is clearly the present value of an annuity of one per period over  $n$  periods at an effective discount rate,  $d$ , namely  $e^{nd}$ . This equation can then be rearranged and written as follows.

$$P = \frac{A}{(1+g)} \cdot e^{nd}$$

Note that if  $r > g$ , then  $d$  is positive

if  $r < g$ , then  $d$  is negative

if  $r = g$ , then  $d$  is zero.

In the special case where  $r=g$  and hence  $d=0$  we saw in section 2.5.2  $e^{nd}=n$ . In this special case the expression given by the above equation reduces to the following.

$$P = \frac{A \cdot n}{(1+g)}$$

In those cases where  $d$  is negative, the value of  $e^{nd}$  can be readily determined by using a scientific calculator as demonstrated in section 2.7.

If required, the amount of this annuity can be determined by multiplying the present value ( $P$ ) by the factor  $1/e^{nd}$  in accordance with the standard relationship, as follows.

$$S = \frac{P}{e^{-nd}}$$

$$\therefore S = \frac{A}{(1+g)} \cdot \frac{e^{nd}}{e^{-nd}} \quad (20)$$

$$= \frac{A}{(1+g)^{2 \cdot nd}}$$

Similarly, in the special case when  $g=r$  and hence  $d=0$ , this expression reduces to

$$S = \frac{A \cdot n}{(1+g)}$$

Example (9) A municipal electricity undertaking currently has an annual income from the sale of electricity of R10 million. Because of escalating costs and normal

growth in sales it is anticipated that income will increase in money terms at the rate of 15% per annum. Assuming an interest rate of 10% per annum, determine the present value of the anticipated income stream over the next decade.

$$P = \frac{A}{(1+g)} \cdot e^{-nd}$$

$$(1+d) = \left(\frac{1+r}{1+g}\right)$$

$$\therefore (1+d) = \frac{1.10}{1.15}$$

$$\therefore d = -0.0435 \quad (-4.35\%)$$

The value of  $e^{nd}$  can be readily determined using a scientific calculator.

In the above example the rate of growth,  $g$ , was taken as the combined value of both escalation in costs and expansion in sales through normal growth.

In general, the growth factor,  $g$ , can be a composite value combining the values of two or more individual growth rates. The general expression is as follows, where  $g_1, g_2$ , etc. are the individual growth rates.

$$(1+g) = (1+g_1)(1+g_2) \dots (1+g_n)$$

Example (10): Consider the previous example where the present annual income from the sale of electricity was R10 million. It is expected that the growth in units sold over the next decade will increase at a mean compound rate of 6% per annum. Over this period it is expected that the undertaking's income will rise in line with the increase in costs generally, which is estimated at 11% per annum. Assume a monetary interest rate of 10% per annum, determine the present value of the income stream over the next decade.

$$(1+g) = (1+g_1)(1+g_2)$$

$$= 1.06 \cdot 1.11$$

$$= 1.1766$$

$$\therefore g = 0.1766 \quad (17.66\%)$$

$$\therefore (1+d) = \left(\frac{1+r}{1+g}\right)$$

$$= \frac{1.10}{1.1766}$$

$$= 0.9349$$

$$\therefore d = -0.0651 \quad (-6.51\%)$$

$$\therefore P = \frac{A}{(1+g)} \cdot e^{-nd}$$

$$= \frac{10}{1.1766} \cdot e^{-0.1 \cdot 10}$$

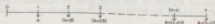
$$= \frac{10}{1.1766} \cdot 0.3426 = \text{R}25\,389\,000$$

## 2.9 Cash flow growing at a linear rate

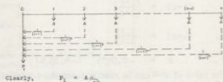
Although cash flows growing at compound rates are more usual in engineering economic problems there are occasions when cash flows growing at a linear rate are encountered. Formulae to deal with this type of cash flow, which is also known as a linear gradient series can readily be established, as follows.

Let A = initial periodic payment (end-of-period)  
B = uniform increase year-by-year after the first year

This cash flow series may be represented diagrammatically as follows.



This cash flow can be considered as two separate cash flows, one involving A only and the other B, as follows. The present value of each (say P<sub>1</sub> and P<sub>2</sub> respectively) can be determined separately then added together to obtain the combined overall present value.



Clearly,  $P_1 = A \cdot v_0^n$



By discounting each periodic payment of the B series to the present, we have

$$P_2 = \frac{B}{(1+r)^1} + \frac{B}{(1+r)^2} + \dots + \frac{B}{(1+r)^{n-1}} + \frac{B}{(1+r)^n}$$

This expression can be simplified in the customary manner by multiplying through by  $(1+r)$ .

$$(1+r)P_2 = \frac{B}{(1+r)} + \frac{B}{(1+r)^2} + \dots + \frac{B}{(1+r)^{n-1}} + \frac{B}{(1+r)^n}$$

If the first expression is subtracted from the second we have

$$(1+r)P_2 - P_2 = \frac{B}{(1+r)} + \frac{B}{(1+r)^2} + \dots + \frac{B}{(1+r)^{n-1}} - \frac{B}{(1+r)^n}$$

$$\therefore P_2 = \frac{B}{r} \left[ \left( \frac{1}{(1+r)} + \frac{1}{(1+r)^2} + \dots + \frac{1}{(1+r)^{n-1}} \right) - \frac{1}{(1+r)^n} \right]$$

The expression in the inner curly brackets is clearly the present value of an annuity of one per period, namely  $a^{(1+r)}$ . The value  $1/(1+r)^n$  in the last term in the square brackets is the present value of a terminal value of one, namely  $v^{(1+r)n}$ . The expression can then be written as follows.

$$P_2 = \frac{B}{r} \cdot (v_0 - v_0^n)$$

The value of P is given by  $P_1 + P_2$ , as follows.

$$P = A \cdot v_0^n + \frac{B}{r} (v_0 - v_0^n) = \left( A + \frac{B}{r} \right) v_0 - \frac{B}{r} v_0^n \quad (21)$$

The amount of this series can readily be obtained by compounding the present value by multiplying by  $1/v^{(1+r)n}$  as follows.

$$S = \frac{P}{v_0^n} = \left( A + \frac{B}{r} \right) \frac{v_0}{v_0^n} - \frac{B}{r} \frac{v_0^n}{v_0^n} = \left( A + \frac{B}{r} \right) v_0 - \frac{B}{r} \quad (22)$$

Example (11): An item of engineering plant costing R5 000 and having an expected life of five years with zero scrap value is estimated to have a total operating cost of R1 000 in the first year of operation and thereafter rising by R100 per annum each year. Assuming a

rate of interest of 10% per annum, what is the present value of the operating costs over the five year period?

$$P = \left( A + \frac{B}{r} \right) v_0 - \frac{B}{r} v_0^n = \left( 5\,000 + \frac{1\,000}{0.1} \right) \cdot 0.7513 - \frac{1\,000}{0.1} \cdot 0.6209 = 2\,000 \cdot 3.7908 - 5\,000 \cdot 0.6209 = 7\,582 - 3\,105 = 4\,477$$

## 2.10 Compounding and discounting more frequently than annually

### 2.10.1 General

Although it is both customary practice and generally quite acceptable and adequate to calculate compound interest in discrete periods of one year, particularly in engineering problems, the standard financial formulae developed earlier in this paper can readily be adapted to deal with the more general case where compounding or discounting occurs more frequently than once a year.

There are two cases to consider, one the general case where compounding is effected at discrete periodic intervals, and the other the special case where periodic compounding is carried to the extreme, namely continuous compounding.

In addition to interest being compounded more frequently than once a year the annual amount of an annuity can be paid in a number of periodic instalments each year. In all the cases considered so far the payment period and the compounding period of an annuity have been the same and equal to one year. In general, though, they need neither be the same nor equal to one year. Not only can payment and compounding be effected more frequently than annually, but the respective periods can also be different. In certain cases the payment period can be greater than the compounding period and in other cases vice versa. For example, an annuity may be paid monthly with interest compounded half-yearly; or be paid quarterly with interest compounded monthly.

### 2.10.2 Nominal and effective interest rates

All the formulae developed so far have been based on annual compounding and annual payment periods for annuities. Consider now the case of compounding more frequently than once a year.

For annual compounding we have seen that the amount (S) of a principal (P) compounded annually at an interest rate r per annum for n years is given by the following expression.

$$S = P(1+r)^n$$

Suppose now that interest is compounded m times a year, the annual interest rate being j. It is then apparent that the interest rate per compounding period is j/m and that the number of compounding periods is mn. The above expression can then be rewritten as follows.

$$S = P(1+j/m)^{mn} \quad (23)$$

The interest rate j is known as the nominal interest rate since it is a rate in name only. By equating the above two expressions we obtain the following relationship.

$$(1+r) = \left(1 + \frac{j}{m}\right)^m \quad (24)$$

$$\therefore r = \left(1 + \frac{j}{m}\right)^m - 1$$

The interest rate r is known as the effective interest rate since it is the overall effective annual rate equivalent to the nominal rate j compounded m times a year.

The above value of r is for discrete compounding. The special case of continuous compounding is considered in section 2.10.3.4.

Example (12): Calculate the amount of a principal of R100 invested for five years at 9% per annum with



interest compounded (a) annually (b) monthly. Also determine the effective rate with monthly compounding.

(a) annual compounding:  $S = 100 \cdot (1.09)^5$   
 $= R156.37$

(b) monthly compounding:  $S = 100 \cdot (1.0075)^{60}$   
 $= R153.86$

effective interest rate:  $r = (1.0075)^{12} - 1$   
 $= 0.0938$   
 $= 9.38\%$

With the more frequent compounding of interest in the monthly case it is clear that both the amount and the effective interest rate are higher than in the case of annual compounding.

As previously shown the present value of a future amount of one is given by the following standard expression.

$$v_{m,r} = (1+r)^{-n}$$

With compounding  $m$  times a year at a nominal interest rate of  $j$  per annum this value is given by the following expression.

$$v_{\frac{j}{m}, m} = \left(1 + \frac{j}{m}\right)^{-mn} \quad (25)$$

This section was by way of an introduction to effective interest rates. Further consideration is given to this subject in section 2.10.3.

## 2.10.3 Annuities

### 2.10.3.1 General expression

The relevant formulae for the present value and amount of an annuity where the payments and compounding are made more frequently than once-a-year may be determined as follows.

- Let
- $P$  = present value of the annuity
  - $S$  = amount of the annuity
  - $A$  = total payment per year
  - $p$  = number of payments per year
  - $j$  = nominal interest rate (per annum)
  - $n$  = numbers of years
  - $m$  = number of compoundings per year
  - $z$  = effective interest rate per payment period
  - $r$  = effective interest rate (per annum)

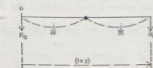
This annuity may be represented diagrammatically as follows where, for the sake of clarity, the diagram has been drawn for  $p = 2$  and  $m = 4$ .



The present value ( $P$ ) of the annuity is determined in the conventional manner by discounting each periodic payment of  $A/p$  at the effective discount rate  $z$  per payment period. Since there are  $p$  payments per year there will be a total of  $pn$  payments.

Hence, 
$$P = \frac{A}{p} \cdot a_{\overline{pn}|z} \quad (26)$$

To determine the value of  $z$  consider the first payment period of this series, as below. Let  $R_0$  represent any initial sum and  $R_1$  its value at the end of the first payment period.



Since there are  $m/p$  compounding periods per payment period it is clear, by inspection, that the following relationship applies to the general case.

$$R_1 = R_0 \left(1 + \frac{z}{p}\right)^{\frac{m}{p}}$$

It is also clear that the following relationship applies

$$R_1 = R_0 (1+z)$$

By eliminating  $R_1$  and  $R_0$  between the above two expressions we arrive at the following relationship.

$$(1+z) = \left(1 + \frac{z}{p}\right)^{\frac{m}{p}} \quad (27)$$

$$z = \left(1 + \frac{z}{p}\right)^{\frac{m}{p}} - 1$$

Equation (26) can be expanded using equation (27) as follows.

$$P = \frac{A}{p} \cdot a_{\overline{pn}|z}$$

$$= \frac{A}{p} \cdot \left[ \frac{1 - (1+z)^{-pn}}{z} \right] \quad (\text{standard expression})$$

$$= \frac{A}{p} \cdot \left[ \frac{1 - \left(1 + \frac{z}{p}\right)^{-\frac{m}{p} \cdot pn}}{\left(1 + \frac{z}{p}\right)^{\frac{m}{p}} - 1} \right]$$

$$P = \frac{A}{p} \cdot \left[ \frac{1 - \left(1 + \frac{z}{p}\right)^{-mn}}{\left(1 + \frac{z}{p}\right)^{\frac{m}{p}} - 1} \right]$$

The amount of the annuity can be determined by multiplying the present value by the compounding factor in the standard manner (based on the general relationship  $a^{n/r} = e^{nr}$  ·  $v^{nr}$  and the analysis in section 2.10.2).

$$S = \frac{P}{v_{\frac{j}{m}, m}}$$

$$= P \left(1 + \frac{z}{p}\right)^{mn} \quad (29)$$

$$S = \frac{A}{p} \cdot \left[ \frac{\left(1 + \frac{z}{p}\right)^{mn} - 1}{\left(1 + \frac{z}{p}\right)^{\frac{m}{p}} - 1} \right]$$

From equation (27) this expression can be rewritten as follows.

$$S = \frac{A}{p} \cdot a_{\overline{pn}|z} \quad (30)$$

Alternative expressions for  $A$  and  $S$  can be derived by expanding, rearranging and expressing equations (28) and (29) in terms of  $r$  by making the following substitution to eliminate  $(1+z)/m$ .

$$r = \left(1 + \frac{z}{p}\right)^m - 1 \quad (\text{equation 24})$$

We then have by substitution and rearrangement

$$P = \frac{A}{p} \cdot \left[ \frac{1 - (1+r)^{-n}}{r} \cdot \frac{r}{(1+r)^{n/p} - 1} \right] \quad (31)$$

$$= \frac{A}{p} \cdot \frac{a_{\overline{n}|r}}{a_{\overline{n/p}|r}}$$

And

$$S = \frac{A}{p} \cdot \left[ \frac{(1+r)^n - 1}{r} \cdot \frac{r}{(1+r)^{n/p} - 1} \right]$$

$$= \frac{A}{p} \cdot \frac{s_{\overline{n}|r}}{s_{\overline{n/p}|r}}$$

From equations (24) and (27) we also have the following relationships between  $r$ ,  $z$  and  $j$ .

$$(1+r) = \left(1+\frac{j}{m}\right)^m = (1+z)^p \quad (33)$$

The present value and the amount of the annuity can be obtained either from equations (28) and (29) directly, or equations (26) and (30) or (31) and (32) indirectly by first calculating the relevant effective interest rate  $z$  or  $r$  from equations (27) or (24). Either way the calculations are readily performed by means of a scientific calculator.

Example (13): Find the present value and the amount of an annuity of R500 annually, payable twice-yearly, for 12 years with interest at the rate of 8% per annum compounded quarterly.

$$\begin{aligned} A &= 500 \\ p &= 2 \\ j &= 0,08 \\ n &= 12 \\ m &= 4 \\ p &= 2 \end{aligned}$$

Using the direct method by employing equations (28) and (29) we have

$$P = \frac{500}{2} \cdot \left[ \frac{1 - (1,02)^{-48}}{(1,02)^2 - 1} \right] = R3\,796,18$$

$$S = \frac{500}{2} \cdot \left[ \frac{(1,02)^{48} - 1}{(1,02)^2 - 1} \right] = R9\,820,98$$

Example (14): Find the present value and amount of an annuity of R50 per month for 15 years with interest at the rate of 8% per annum compounded half-yearly.

Using the indirect equations (26) and (30) with (27), and noting that R50 per month is R600 per year, we have

$$\begin{aligned} A &= 600 \\ p &= 12 \\ j &= 0,08 \\ n &= 15 \\ m &= 2 \end{aligned}$$

$$\therefore z = \left(1+\frac{j}{m}\right)^{\frac{1}{p}} - 1$$

$$= (1,04)^{\frac{1}{12}} - 1$$

$$= 0,0065582 \quad (0,65582 \%)$$

$$\therefore P = \frac{A}{p} \cdot a_{\overline{pn}|z}$$

$$= \frac{600}{12} \cdot a_{\overline{180}|0,0065582}$$

$$= 50 \cdot 105,4682 = R5\,273,41$$

$$\therefore S = \frac{A}{p} \cdot s_{\overline{pn}|z}$$

$$= \frac{600}{12} \cdot s_{\overline{180}|0,0065582}$$

$$= 50 \cdot 342,0755 = R17\,103,76$$

### 2.10.3.2 Payment period equal to one year

Although this special case is covered by the general expressions developed in the last section it is nevertheless a case that frequently arises and as such warrants separate treatment to highlight the difference. In this special case  $p=1$  and  $m$  is any finite whole number.

Since  $p=1$  it follows that  $z=r$  by definition. Making these substitutions in equation (27) we have

$$r = \left(1+\frac{j}{m}\right)^m - 1 \quad (\text{same as equation (24)})$$

Then from equations (26) and (30) and putting  $p=1$  and  $z=r$  again, we have

$$P = A \cdot a_{\overline{n}|r} \quad (\text{same as equation (4)})$$

$$S = A \cdot s_{\overline{n}|r} \quad (\text{same as equation (9)})$$

Also, from equation (2) we have

$$P = S \cdot v_{\overline{n}|r}$$

It should be clearly noted that  $r$  is the effective rate of interest and not the nominal annual rate. The effective rate is given by equation (24), namely

$$r = \left(1+\frac{j}{m}\right)^m - 1$$

This effective rate ( $r$ ) is the rate that must be used in the above equations to calculate the present value and amount of this annuity.

It should be noted that when  $m=1$  the above expressions reduce to the special case of annual payments with annual compounding as considered earlier in section 2.5. We then have  $r=j$ .

Example (15): Determine the present value and amount of an annuity of R100 per annum, paid at the end of each year, for eight years. Interest is calculated at the rate of 6% per annum compounded monthly.

$$\begin{aligned} A &= 100 \\ n &= 8 \\ j &= 0,06 \\ m &= 12 \end{aligned}$$

$$\therefore r = \left(1+\frac{j}{m}\right)^m - 1$$

$$= (1,005)^{12} - 1$$

$$= 0,061678 \quad (6,1678 \%)$$

$$\therefore P = A \cdot a_{\overline{n}|r}$$

$$= 100 \cdot a_{\overline{8}|0,061678}$$

$$= 100 \cdot 6,1688 = R616,88$$

$$\text{similarly } S = A \cdot s_{\overline{n}|r}$$

$$= 100 \cdot s_{\overline{8}|0,061678}$$

$$= 100 \cdot 9,9573 = R995,73$$

### 2.10.3.3 Equal payment and compounding periods

There is another special case that often occurs. This is the case where  $p=m$  and  $m$  is any finite whole number.

As before we have for the effective rate

$$r = \left(1+\frac{j}{m}\right)^m - 1$$

Consider first the expression for the present value. Putting  $p = m$  in equation (28) we have

$$P = \frac{A}{i} \cdot \frac{1 - (1 + \frac{i}{m})^{-mn}}{(1 + \frac{i}{m}) - 1} \quad (34)$$

$$= \frac{A}{i} \cdot \frac{1 - (1 + \frac{i}{m})^{-mn}}{j/m} \quad (35)$$

$$P = A \cdot \frac{1 - (1 + \frac{i}{m})^{-mn}}{r} \cdot \frac{r}{j} \quad (36)$$

$$= A \cdot \frac{r}{j} \cdot \frac{1 - (1 + \frac{i}{m})^{-mn}}{r} \quad (37)$$

The corresponding equations for the amount of the annuity can be derived in a similar manner.

$$S = \frac{A}{i} \cdot \frac{(1 + \frac{i}{m})^{mn} - 1}{j/m} \quad (38)$$

$$= \frac{A}{i} \cdot r \cdot \frac{(1 + \frac{i}{m})^{mn} - 1}{r} \quad (39)$$

Again, by simplifying equation (36) we also have

$$S = A \cdot \frac{(1 + \frac{i}{m})^{mn} - 1}{j} \quad (40)$$

$$= A \cdot \frac{r}{j} \cdot \frac{(1 + \frac{i}{m})^{mn} - 1}{r} \quad (41)$$

From equations (37) and (41) we also have

$$P = S \left(1 + \frac{i}{m}\right)^{-mn}$$

$$= S \cdot v_{\frac{i}{m}}$$

The above equations for this special case where  $m = p$  are frequently used in engineering calculations. They are of importance in those instances where a given annual sum or quantity arises periodically in equal instalments during the course of the year. Such as for example in the case of a capital project that generates a given annual income uniformly across the year at the same interval (payment period) as the compounding period.

Example (16): The estimated income from the sale of a certain product is R100 000 per annum with this income accruing monthly in equal amounts. Determine the present value of this income cash flow if it is sustained over a seven year period. Interest is calculated at the rate of 8% per annum compounded monthly.

$$P = \frac{A}{i} \cdot a_{\overline{mn}|i}$$

where  $A = 100\ 000$

$$n = 12$$

$$j = 0,08$$

$$\frac{i}{m} = 0,006667$$

$$m = 7$$

$$\therefore P = \frac{100\ 000}{0,006667} \cdot a_{\overline{84}|0,006667}$$

$$= \frac{100\ 000}{0,006667} \cdot 64,15926 = 8534\ 661$$

Since the income was an estimate the answer cannot be expressed to the calculated degree of accuracy. Within the limits of accuracy of the estimate the present value of this income cash flow may be said to be R853 000.

Example (17): Calculate the present value and amount of an annuity of R60 per month for 15 years at an interest rate of 9% per annum compounded monthly.

$$P = \frac{A}{i} \cdot a_{\overline{mn}|i}$$

where  $P = 600$  (R60 per month)

$$n = 12$$

$$j = 0,09$$

$$m = 15$$

$$\therefore P = \frac{600}{0,0075} \cdot a_{\overline{180}|0,0075}$$

$$= 50 \cdot 98,5934 = 4\ 929,57$$

$$\text{similarly } S = \frac{A}{i} \cdot s_{\overline{mn}|i}$$

$$= \frac{600}{0,0075} \cdot s_{\overline{180}|0,0075}$$

$$= 50 \cdot 378,4058 = 18\ 920,29$$

### 2.10.3.4 Continuous compounding

We have seen that the effective interest rate for discrete compounding is given by the following expression.

$$r = \left(1 + \frac{i}{m}\right)^m - 1$$

In discrete compounding  $m$  is generally equal to 1, 2, 4, 12, 52 or 365 depending upon whether compounding is effected yearly, twice-yearly, quarterly, monthly, weekly or daily. The value of  $m$ , however, can be increased to the limit, with compounding then being continuous. This is also the law of organic growth.

To determine the limits of the above expression as  $m$  tends to infinity make the following substitution.

$$\text{Put } h = \frac{m}{j}$$

$$\text{Then } \left(1 + \frac{i}{m}\right)^m = \left(1 + \frac{i}{h}\right)^{h \cdot j}$$

Consider next the expression  $(1 + i/h)^h$ . The value of this expression as  $h$  tends to infinity is the base of natural or Napierian logarithms and is expressed by the symbol  $e$  where  $e = 2,71828 \dots$

$$\therefore \lim_{h \rightarrow \infty} \left(1 + \frac{i}{h}\right)^h = e \quad (\text{by definition}) \quad (42)$$

$$\therefore \lim_{m \rightarrow \infty} \left(1 + \frac{i}{m}\right)^m = e^j$$

In the limit equation (24) above for the effective interest rate then reduces to the following expression

$$r = e^j - 1 \quad (43)$$

Consider next the standard discounting formula, namely

$$v_{nr} = (1+r)^{-n}$$

By substituting the above value of  $r$  from equation (43) we obtain

$$v_{nr} = e^{-jn} \quad (44)$$

$$(45)$$

$$\therefore P = S e^{-jn} \quad (46)$$

$$= S v_{nr}$$

It now remains to determine the present value and the amount of an annuity as  $m$  tends to infinity. There are two cases to consider. One where  $p = 1$  and the other where  $p = m$ .

Consider first the case where  $p = 1$ . Putting  $p = 1$  in equations (28) and (29) and substituting  $e^j$  for  $(1+j/m)^m$  (equation (42)) we obtain

$$P = A \cdot \left[ \frac{1 - e^{-jn}}{e^j - 1} \right] \quad (47)$$

$$S = A \cdot \left[ \frac{e^{jn} - 1}{e^j - 1} \right] \quad (48)$$

Also, from equation (45) we have

$$P = S e^{-jn}$$

Further, since

$$r = e^j - 1 \quad (\text{equation (43)})$$

$$e^j = (1+r)$$

Making this substitution in equations (47) and (48) we have

$$P = A \cdot \left[ \frac{1 - (1+r)^{-n}}{r} \right] \quad (\text{by definition})$$

$$P = A \cdot a_{\overline{n}|r}$$

$$\text{Similarly } S = A \cdot s_{\overline{n}|r}$$

Also, from equation (46) we have

$$P = S \cdot v_{\overline{n}|r}$$

The values  $P$  and  $S$  can then either be computed by employing the standard expressions  $a^{\overline{n}|i}$  and  $s^{\overline{n}|i}$  where  $r = e^j - 1$  or, more directly, from equations (47) and (48).

The above equations, however, are of limited practical application since this special case implies an annual payment ( $A$ ) made at the end of each year, with interest compounded continuously. This is not a situation that would normally be encountered.

Of more importance is the special case where  $p = m$ . In this case the annuity payments are rising continuously with interest also being compounded continuously. This case is often of use in engineering economic studies. For instance, income or payments may be spread equally and evenly throughout the year rather than being concentrated at a particular time in the year. A typical example would be the income accruing to an electricity undertaking from the sale of electricity. Another example would be the growth in units sold by an electricity undertaking.

In this special case where  $p = m$  the present value and the amount of an annuity with continuous compounding may be determined by putting  $p = m$  and  $(1+j/m)^m = e^j$  in equations (28) and (29), as follows

$$P = A \cdot \left[ \frac{1 - e^{-jn}}{j} \right] \quad (49)$$

$$S = A \cdot \left[ \frac{e^{jn} - 1}{j} \right]$$

Also, from equation (45) we have

$$P = S e^{-jn} \quad (50)$$

It is important to note that the above expressions for the present value and the amount of an annuity are based on an annual payment ( $A$ ) which is as-

sumed to rise continuously and uniformly across the year.

As before the effective interest rate is given by

$$r = e^j - 1$$

Hence, equations (49) and (50) can also be expressed as follows

$$P = A \cdot \frac{r}{j} \cdot a_{\overline{n}|r} \quad (51)$$

$$S = A \cdot \frac{r}{j} \cdot s_{\overline{n}|r} \quad (52)$$

Also, from equation (46) we have

$$P = S \cdot v_{\overline{n}|r}$$

Example (18): The units sold by an electricity undertaking are at present 250 GWh per annum. Assuming compound growth of 5% per annum what will be the estimated sales in 10 years' time?

$$P = 250 \cdot 10^5$$

$$\therefore S = 250 \cdot 10^5 \quad (\text{equation (44)})$$

$$\text{where } P = 250$$

$$j = 0.05$$

$$n = 10$$

$$\therefore S = 250 \cdot 1.647$$

$$= 411.75 \text{ GWh}$$

Since this is merely an estimate three figure accuracy is adequate and the sales in ten years' time may be said to be 412 GWh.

The above calculation is greatly facilitated by the use of a scientific calculator, the value being obtained directly. There is no need to resort to laboratory log tables.

In engineering problems there is generally little point in resorting to continuous compounding. Continuous compounding can, however, be of value in certain special cases, such as the example considered above relating to the annual growth in energy consumption in electricity undertakings. In this case the trend of the twelve month moving average should follow this law. Similarly, income from the sale of electricity, which is based on units sold, should also follow this law. In most other cases involving income and expenditure these are generally monthly related and monthly compounding would accordingly probably be more accurate than continuous compounding. In practice it is generally not possible to invest money where interest is compounded on daily balance. If so though, the interest rates are generally relatively low and this type of investment would normally be avoided.

### 2.10.3.5 Compounding period

It is informative to study the influence of different compounding periods on the effective rate of interest. In other words, the influence on the effective interest rate as  $m$  is varied from one to infinity. The effect is best illustrated by calculating the effective interest rates for given nominal values for varying compounding periods. Consider the following example.

Example (19): Calculate the effective interest rate for nominal rates of 6%, 8% and 10% per annum for values of  $m = 1, 2, 4, 12, 52, 365$  and infinity. These periods correspond to compounding yearly, twice-yearly, quarterly, monthly, weekly, daily and continuously.

The relevant formulae for calculating the effective rates are the following.

$$= \text{finite} : r = \left(1 + \frac{j}{m}\right)^m - 1 \quad (\text{equation (24)})$$

$$= \text{infinite} : r = e^j - 1 \quad (\text{equation (43)})$$

m	6%	8%	10%
1	6.00	8.00	10.00
2	6.09	8.16	10.25
4	6.14	8.24	10.38
12	6.17	8.30	10.47
52	6.18	8.32	10.51
365	6.18	8.33	10.52
∞	6.18	8.33	10.52

From an examination of the values in the above table it is clear that after  $m = 12$  there is little difference in the effective rate right up to the limit of continuous compounding. Since in most engineering problems the basic data is generally not known to an accuracy greater than two or possibly three significant figures, there is usually little point in going beyond monthly compounding. There is, however, a significant difference between annual compounding and monthly compounding.

### 2.11 Incidence of cash flows

The standard convention is to assume that all cash flows arise at the end of the compounding period, for example year-end for annual compounding. Although this convention is generally quite adequate for most engineering problems there are occasions when it is necessary to consider cash flows arising at other times within the compounding period. The two most common cases are mid-period and start of period.

Where cash flows are spread fairly uniformly across the compounding period, generally a year, a closer approximation to the actual situation can be achieved by assuming that the cash flows all arise simultaneously at the middle of the compounding period. For example, a large construction project entails income and expenditure cash flows usually continuous over the year. In most practical cases these cash flows can be assumed to arise at the end of each month. Alternatively, the total annual cash flow can be assumed to arise at the middle of the year. In other rare cases the beginning of the year may be more appropriate.

To illustrate the effect of varying the compounding and discounting reference point, consider the case of a given uniform annual cash flow arising year-end. The present value of this series, an annuity, is given by the following standard expression.

$$P = A \cdot a_{\overline{n}|r}$$

If the cash flows of this series are assumed to arise not at the year-end, but rather at the beginning of the year, then the whole series is effectively displaced or moved back in time by one year. Hence the present value of the series is similarly moved back in time by one year. To bring this displaced present value back to the reference time of the present it is necessary to compound the calculated present value forward by one year, as follows.

$$P = A \cdot (1+r) \cdot a_{\overline{n}|r}$$

Alternatively, this equation can be expressed by expanding the expression using equation (3) and then by rearranging, or directly from inspection of the cash flow series, as

$$P = A (1 + a_{\overline{n}|r})$$

On the other hand, if the cash flows are assumed to arise rather at mid-year, then it is clear that the whole series is now shifted back by half-a-year in time. To bring it forward to the present it is accordingly necessary to compound it by half-a-year, as follows.

$$P = A \cdot (1 + \frac{r}{2}) \cdot a_{\overline{n}|r}$$

A similar argument applies to the calculation of the amount of an annuity, the value  $s$  being multiplied in each case by  $(1+r)$  for a shift to the beginning of the year and by  $(1+r/2)$  for a shift to the middle of the year.

As mentioned, a further possibility is to assume cash

flows arising at the end of each month. The present value and the amount of this annuity with the compounding period and the interest rate per period being  $1/n$  and  $r/12$  respectively, are then given by the standard expressions as follows.

$$P = A \cdot a_{\overline{12n}|r/12}$$

$$S = A \cdot s_{\overline{12n}|r/12}$$

A final possibility is to assume that the annual cash flows arise continuously across the year with continuous compounding. The standard expressions are the following.

$$P = A \cdot \left[ \frac{1 - e^{-jn}}{j} \right] = A \cdot \frac{r}{j} \cdot a_{\overline{n}|r} \quad (\text{equation (49)})$$

$$S = A \cdot \left[ \frac{e^{jn} - 1}{j} \right] = A \cdot \frac{r}{j} \cdot s_{\overline{n}|r} \quad (\text{equation (50)})$$

The effect of these five alternatives, namely discrete compounding year-end, mid-year, beginning-year and month-end, and continuous compounding is perhaps best illustrated by an example.

Example (20):  $j = 10\%$  per annum,  $n = 25$  years

Method	P/A	S/A
Discrete compounding:		
annual year-end ... ..	9.08	98.4
annual mid-year ... ..	9.53	103.3
annual beginning-year ... ..	9.98	108.2
monthly month-end ... ..	9.17	110.6
Continuous compounding (distributed payments) ...	9.18	111.8

The values P/A and S/A are respectively the present value and the amount of an annuity of one per annum for the five different methods.

From these figures it is clear that there is little difference between monthly compounding and continuous compounding. As to be expected the mid-year figures are intermediate between end-year and beginning-year; with the mid-year figures being a good compromise.

In most practical engineering problems the standard annual end-year convention is quite adequate. The foregoing analysis indicates how the alternative methods can be applied and the order of magnitude of the effect on the present value and the amount of an annuity.

### 2.12 Inflation

Inflation in price levels in recent years has reached heights that were virtually unknown in the past. Indeed, the relatively high levels attained have now been sustained for so long that it may be said that inflation today is endemic of our society and likely to remain with us for the foreseeable future. The relatively low inflation rates of the past are therefore unlikely to be seen again. It is accordingly necessary today to take inflation into account in any economic study.

By inflation is meant the change in general price levels with time. It is effectively the change in the purchasing power of money. This change can be brought about by changes in a variety of factors, including labour and material costs and technological developments.

Economic studies can be made either in "money terms" or "real terms". By money terms is meant the value of goods and services expressed in terms of what they actually cost at a given time. But because of the erosion of the value of money with time on account of inflation, a given sum of money will buy less in the future than it will now. Alternatively, a given article will cost more in money terms in the future than it does at present. If the costs of goods and services are expressed in terms of units of constant purchasing power then such costs are known as the costs in real terms. For example, if an individual's income in the past purchased certain goods and services and if his income today, increased in money terms because of inflation, only purchases the same goods and services, then it is said

that there has been no change in his income in real terms. Similarly, if the increased income buys more, then there has been an increase in real terms; if less, then a decrease.

In the past when inflation rates were relatively low it was generally agreed that it was probably simplest to undertake economic studies in real terms. It is most important to note though that in such cases the interest rates must also be in real terms, namely relative to the inflation rate. This aspect will be commented on in more detail later.

The costs of goods and services, however, do not generally all increase in cost or price at the same rate, some increasing at rates greater or less than others. In such cases this relative difference must be taken into account by way of differential rates in any analysis in real terms.

But I would suggest that such treatment today is largely artificial. It is surely more realistic to express all costs and cash flows in money terms. If, however, it is required to express figures in real terms for any particular reason, then this can readily be done by employing an appropriate discount rate reflecting the decreased purchasing power of money. In general, though, a money term analysis is probably best if future cash flows are determined by immediate decisions, income tax considerations or long term contracts. On the other hand a real term analysis is more suited to those cases where cash flows are determined largely by market forces.

The distinction between real and money terms is important in cash flow studies where the value of one item is fixed in money terms and the others are varying with time, for example because of growth and inflation. A typical example is where financing is by way of a loan, such as in municipal financing, the repayments of principal and interest being fixed in money terms.

The influence of inflation on interest rates is important. Generally speaking increased inflation is reflected by increased interest rates such that the investor's return in real terms remains reasonably constant. Historically speaking investors expect returns in real terms of around 3% on risk-free investments, such as loan capital, and around 7% on investments that are not risk-free, such as shareholders equity capital. In other words, if for example we assume an interest rate of 3% in real terms, then with inflation running at 10% per annum investors would expect an actual return of around 13% in money terms. But a positive return in real terms is not always obtained since interest rates are frequently dictated by government policy and negative rates of return in real terms are accordingly not uncommon today.

Since growth in economic studies has an effect similar to inflation, the influence of both these factors on compound interest formulae will be considered. The technique for adjusting cash flows for both inflation and growth is a most important one and a clear understanding of the underlying principle is essential for a proper appreciation of how inflation, growth and other similar factors are taken into account in economic studies.

Firstly, consider the effect of inflation alone. Any future sum of money (S) n years hence can be converted to its real term equivalent (S') by dividing by a relevant factor reflecting the decreased purchasing power of money.

In this analysis symbols with a dashed suffix refer to real terms (namely, rates net of inflation) while plain symbols refer to money terms (namely, actual rates with inflation).

Let  $f$  = inflation rate (namely, increase in the general price level, or decrease in the purchasing power of money)

$$\text{Then } S' = \frac{S}{(1+f)^n}$$

Consider next the present value of this future sum.

Let  $r$  = interest rate

$$\text{Then } P = S' \cdot \frac{1}{(1+r)^n} = \frac{S}{(1+r)^n (1+f)^n}$$

$$\text{and } P = S' \cdot \frac{1}{(1+r)^n} = \frac{S}{(1+r)^n (1+f)^n}$$

From an inspection of the above two alternative expressions for P we note that

$$(1+r) = (1+f)(1+r')$$

$$\therefore r' = \left( \frac{1+r}{1+f} \right) - 1 \approx r - f$$

As a final example, consider the general case of the present value of an annuity with compound growth discussed earlier in section 2.8.

$$P = \frac{A}{(1+g)^n} \cdot \frac{1}{(1+r)^n} \quad (\text{equation (19)})$$

Let  $b$  = growth rate (physical increase, for example in sales volume)

$i$  = escalation in cost (or price) per unit

$g$  = overall growth rate

$d$  = overall effective discount rate

$$\text{Money terms : } (1+g) = (1+b)(1+i) \\ (1+d) = \frac{(1+r)}{(1+f)} = \frac{(1+r')}{(1+f)}$$

$$\text{Real terms : } (1+g') = (1+b)(1+i') \\ (1+d') = \frac{(1+r')}{(1+f)} = \frac{(1+r'')}{(1+f)}$$

$$\text{But we have but } (1+r') = \frac{(1+r)}{(1+f)} \quad \text{and similarly } (1+i') = \frac{(1+i)}{(1+f)}$$

By substitution in the above expressions for  $(1+g')$  and  $(1+d')$  we eliminate  $r'$  and  $i'$  and obtain

$$(1+g') = \frac{(1+b)(1+i)}{(1+f)} \quad \text{and} \quad (1+d') = \frac{(1+r)}{(1+f)}$$

The present value of the annuity can then be obtained in both money and real terms by substitution of the relevant values of  $g$  and  $d$  (or  $g'$  and  $d'$ ) in the formula (equation (19)).

Example (21): The present income from a project is R100 000 per annum. It is expected that sales will expand at the rate of 3% per annum, and selling price by 9% per annum because of increased production costs. Calculate the present value of this income stream in money terms and real terms over a seven year period assuming an interest rate of 10% per annum and an 8% per annum increase in the general price level.

$$A = 100\,000 \quad r = 0.10 \\ b = 0.03 \quad i = 0.09 \\ g = 0.09 \quad n = 7$$

$$\text{Money terms : } (1+g) = 1.03 \cdot 1.09 \quad \therefore g = 0.125 \quad (12.5\%)$$

$$(1+d) = \frac{1.10}{1.08} \quad \therefore d = -0.0202 \quad (-2.02\%)$$

$$\text{Real terms : } (1+g') = \frac{1.03 \cdot 1.09}{1.08} \quad \therefore g' = 0.0395 \quad (3.95\%)$$

$$(1+d') = \frac{1.10}{1.08} \quad \therefore d' = -0.0202 \quad (-2.02\%)$$

The present value of the annuity in both money and real terms can be obtained by substitution of the relevant values in the general equation.

$$P = \frac{A}{(1+g)^n} \cdot \frac{1}{(1+r)^n} \quad (\text{equation (19)})$$

$$\text{Money terms : } P = \frac{100\,000}{1.125^7} \cdot \frac{1}{1.10^7} = 3676\,900$$

$$\text{Real terms : } P = \frac{100\,000}{1.0395^7} \cdot \frac{1}{1.10^7} = 3731\,300$$

It is of interest to note that if it were not for the effect of the factors  $(1+g)$  and  $(1+f)$  in the denominator of the present value formula, the present value of this series would be the same in both money terms and real terms. From a study of the diagram in section 2.8 it is clear that this factor  $(1+g)$  or  $(1+f)$  comes about because of the convention adopted, namely A is assumed to arise year-end in the first year.

A study of the above formulae reveals that to a first approximation the effective growth and discount rates are given by the algebraic sum of the component rates.

For instance, in the above example in money terms the effective growth rate is  $3+9=12\%$  (12.3% true) while the discount rate is  $10-9-9=-2\%$  (-2.02% true). These approximate rates are often quite adequate in economic studies and, being in whole numbers, have the advantage that annuity tables may readily be employed. The inflation rate or real terms discount rate,  $f$ , reflecting the decreased purchasing power of money, can usually be determined from the relevant price index, for example the wholesale, retail or consumer price index, as may be appropriate.

## 2.13 Summary

The development of the various compound interest formulae in the previous sections may have created the impression that there are a large and bewildering number of different equations. This is not so. The various identities have been summarised in section 2.6. As far as the basic compound interest formulae for annuities are concerned, these may be grouped under three main headings, as follows.

- (a) general expression.
- (b) single annual payment.
- (c) distributed annual payment.

The general case covers positive integer values of  $m$  (number of compoundings per year) and  $p$  (number of payments per year). One or the other of the ratios  $m/p$  or  $p/m$  must be an integer and not fractional.

The single payment case is the special case where  $p=1$  and  $m$  is any positive integer ranging from one to infinity. This implies one single year-end payment with compounding generally more frequently than once a year.

The distributed payment case is a further special case where  $p=m$  and  $p$  and  $m$  are any positive integers ranging from one to infinity. This implies the annual payment (A) being evenly distributed across the year in a number of smaller uniform payments in accordance with the number of compoundings or payments per year.

Compounding may be either discrete or continuous. Discrete compounding refers to those cases where  $m$  and  $p$  are finite and continuous compounding to those where  $m$  is infinite.

The various relationships between the nominal interest rate ( $j$ ) and the effective interest rate ( $r$ ) are given by the following equations.

$$\text{discrete compounding} \quad r = (1 + \frac{j}{m})^m - 1$$

$$\text{continuous compounding} \quad r = e^j - 1$$

Note that in the special case where  $m=p=1$  the discrete compounding formula reduces to  $r=j$ .

The various formulae for the present value (P/A) and the amount (S/A) of an annuity of one per year, and the present value (P/S) of a future sum of one, may be expressed as follows.

Value	General expression $p, m = \text{integers}$	Single annual payment $p=1, m=1$	Distributed annual payment $p=m=1$
$\frac{P}{A}$	$\frac{1}{j} \cdot \frac{1 - (1+j)^{-n}}{1 + \frac{j}{m}}$	$\frac{1 - (1+j)^{-n}}{j}$	$\frac{1}{j} \cdot \frac{1 - (1+j)^{-n}}{m}$
$\frac{S}{A}$	$\frac{1}{j} \cdot \frac{(1+j)^n - 1}{1 + \frac{j}{m}}$	$\frac{(1+j)^n - 1}{j}$	$\frac{1}{j} \cdot \frac{(1+j)^n - 1}{m}$
$\frac{P}{S}$	$\frac{1}{(1+j)^n}$	$\frac{1}{(1+j)^n}$	$\frac{1}{(1+j)^n}$

In using the above standard expressions it is only necessary to determine the appropriate effective interest rate ( $r$ ) from the appropriate equation above. Alternatively, a value for  $r$  may merely be assumed without calculation. Also note that all the above equations are in terms of the standard expressions  $a/n\%$ ,  $s/n\%$  and  $v/n\%$ .

If the above standard equations are committed to memory any compound interest problem can readily be solved.

## 3. RETIREMENT AND REPLACEMENT OF ASSETS

### 3.1 General

An asset that has been employed for a number of years may be either retired or replaced for any one of several reasons, all of which fall under one of two broad headings, namely physical or functional. The physical reasons are either use-related (wear and tear, reduction or depletion of natural resources, etc.) or time-related (natural deterioration such as corrosion, rust and ageing of materials, and theft, accidents, etc.).

The functional reasons are attributable either to obsolescence (new or improved machines that perform more efficiently, impaired serviceability of plant that results in lowered performance, etc.) and inadequacy (too small for duty or change in the amount or type of service requirements — all of which render the asset either inadequate or uneconomic for its duty, change in public taste and habits, etc.).

The above reasons are not mutually exclusive and assets may be retired or replaced for several reasons and not one alone.

There is a distinction between retirement and replacement. Retirement refers to disposal of the asset by the owner and does not necessarily imply scrapping. Replacement on the other hand means retiring an asset and replacing it with another.

When the asset is retired or replaced it generally has some residual, salvage or scrap value. The difference between the initial cost and this residual value is known as the wasting or depreciable portion of the asset. Economic, financial and accountancy considerations necessitate a closer look at depreciation and the various methods of providing for it under different circumstances.

### 3.2 Depreciation provision

#### 3.2.1 General

Depreciation provision is the system of providing for the wearing or wasting portion of a capital asset in a convenient, appropriate and systematic manner over its useful life. The system adopted should generally allow the depreciation provision to match as closely as possible the actual rate of depreciation or the service obtained from the asset.

As mentioned earlier there are three main areas of concern in depreciation provision, namely economic, accountancy and financial.

In economic studies we are generally only concerned with the initial cost of the asset, its residual or scrap value, the period involved and the rate of interest. What happens in intermediate years is of little concern in an investment analysis since there is no intention to sell or otherwise dispose of the asset before the end of the planned economic life.

The intermediate years are, however, of interest from the accountancy and financial points of view. How the plant is written down in the books is clearly of concern in determining the net value of the asset at any time. This accountancy provision may or may not be related to the financial provision, namely the actual method of capital funding. For instance, the funds employed to acquire an asset may be repaid in one manner but recharged in another. In the municipal context for example, the City Treasurer may raise a loan and repay it in a certain agreed manner but debit it to the electricity undertaking in a completely different manner.

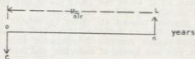
#### 3.2.2 Economic provision

In economic studies as mentioned earlier, we are not concerned with intermediate values, namely the so-called book values in any particular year. All that is required in economic studies is to determine expressions connecting the capital cost of the asset, its residual or scrap value, the useful life of the asset and the interest rate. This information can be expressed either as a net present value or an equivalent annuity, as follows.

- Let  $C$  = initial capital cost
- $L$  = residual or scrap value
- $n$  = useful life

$r$  = interest rate  
 $P$  = net present value  
 $A$  = equivalent annuity

The situation may be depicted diagrammatically as follows.



The net present value can then be expressed as follows by discounting the residual value to the present.

$$P = C - L \cdot \frac{1}{s^{nr}} \quad (53)$$

The equivalent annuity is then given by the usual standard expression.

$$A = \frac{P}{\frac{1 - \frac{1}{s^{nr}}}{r}} \quad (54)$$

$$= \frac{C - L \cdot \frac{1}{s^{nr}}}{\frac{1 - \frac{1}{s^{nr}}}{r}}$$

By appropriate substitutions and rearrangement of equation (54) above, this equivalent annuity can be expressed in three further forms, as follows.

(55)

(56)

(57)

$$A = \frac{C - L \cdot \frac{1}{s^{nr}}}{\frac{1 - \frac{1}{s^{nr}}}{r}}$$

Since  $s^{nr} = \frac{1}{s^{-nr}}$ , we have by substitution

$$A = \frac{C - L \cdot \frac{1}{s^{nr}}}{\frac{1 - \frac{1}{s^{nr}}}{r}}$$

Also, since  $r = \frac{1}{s} - \frac{1}{s^2}$  (equation (1)) we have by substitution

$$A = \frac{C - L \cdot \frac{1}{s^{nr}}}{\frac{1 - \frac{1}{s^{nr}}}{\frac{1}{s} - \frac{1}{s^2}}}$$

$$= \frac{(C-L) \cdot s}{1 - \frac{1}{s^{nr}}} + Cr$$

Similarly, by substitution from equation (1), we have

$$A = \frac{C - L \cdot \frac{1}{s^{nr}}}{\frac{1 - \frac{1}{s^{nr}}}{\frac{1}{s} - \frac{1}{s^2}}}$$

$$= \frac{(C-L) \cdot s}{1 - \frac{1}{s^{nr}}} + Cr$$

Any of the above four equations can be used to determine the value of the equivalent annuity.

Equation (56) is one of the expressions most commonly employed. The wasting or depreciable portion of the asset, namely  $(C-L)$ , is converted to an annuity by dividing through by  $s$ . This annuity gives a capital sum  $(C-L)$  at the end of the term to cover the depreciable portion which, along with the salvage value  $L$ , will restore the capital to its initial value at the end of the period. Since the initial capital outlay is not recovered until the end of the term, interest amounting to  $Cr$  must be charged annually. This expression is known as the sinking fund method of depreciation provision. This method provides for a certain sum of money,  $(C-L)/s^{nr}$ , to be placed annually in a so-called "sinking fund", which fund may be either real or notional. The sums set aside annually in this fund accumulate with compound interest to a value sufficient to

replace the wasting or depreciable portion of the asset at the end of its useful life.

Example (22): A machine costing R12 000 will have to be replaced in seven years' time at the same cost. The scrap value is estimated to be R2 000. Calculate the annual amount that must be set aside at the end of each year to ensure that adequate funds are available to replace this machine at the end of its life. Interest is at 9% per annum compounded annually.

Using equation (56) we have

$$A = \frac{(C-L)}{s} + Cr$$

Where  $C = 12\ 000$

$L = 2\ 000$

$r = 0,09$

$n = 7$

$$A = \frac{10\ 000}{s} + 12\ 000 \cdot 0,09$$

$$= \frac{10\ 000}{9,200} + 1\ 080$$

$$= 1\ 087 + 1\ 080 = R2\ 167$$

The annual sinking fund provision is therefore R1 087 per annum and the loss of interest on capital R1 080 per annum, making a total annual depreciation provision of R2 167.

### 3.2.3 Accountancy provision

The accountancy or bookkeeping provision made to cover depreciation is largely arbitrary since it cannot be precisely determined. Several methods are employed in practice with the objective of writing down the initial cost of the asset at different rates to suit different requirements or circumstances. The written-down value at any time is known as the book-value.

In private enterprise the annual provision for depreciation is important from the tax point of view. In the public sector, however, no tax as such is paid and there is accordingly no need for any accountancy provision on this account.

Also, in the case of municipalities, capital projects are generally funded by way of public loans. Hence in these cases the depreciation provision is essentially redemption provision. The method of redemption is normally determined by the City Treasurer and this method should normally be applied in any economic cash flow study. The methods of financial provision are considered in section 3.2.4.

The three main methods of depreciation provision are the sinking fund, straight-line and reducing-balance methods. The sinking fund method gives a smaller write-off in the earlier years, the straight-line method, as its name implies, a uniform write-off, and the reducing-balance method a faster write-off in the earlier years.

In the sinking fund method a uniform amount is credited each year to a sinking fund where it accumulates with compound interest to an amount at the end of the useful life which is sufficient to cover the wasting portion of the asset. Although this method was popular some years ago, particularly in the public sector, it is not commonly employed today.

Adopt previous terminology and let

$m$  = any intermediate year

$V$  = book value (year  $m$ )

The book value in any year is then the initial cost  $(C)$  less the accumulated value of the sinking fund provision. Hence,

$$V = C - \frac{(C-L)}{s} \cdot \frac{1}{s^{mr}}$$



The straight-line method entails a uniform pro-rata write-off each year for depreciation, with no built-in allowance for interest. It is simple to apply and often employed.

Let  $F$  = uniform annual write-off  
 $n$  = useful life (years)

Then by definition of the straight-line method

$$F = \frac{(C-L)}{n}$$

$$\therefore V = C - \frac{(C-L)n}{n}$$

The reducing-balance method is suited to items of plant that depreciate more rapidly in the early years, such as motor vehicles and mechanical plant. Under this method a constant rate of depreciation is applied each year to the progressively decreasing book value. No direct provision is made for interest.

Let  $f$  = depreciation rate (per unit per annum)

Then by definition of the reducing-balance method

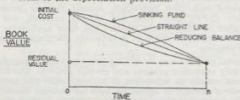
$$L = C(1-f)^n$$

$$\therefore f = 1 - \sqrt[n]{\frac{L}{C}}$$

$$\text{Also } V = C(1-f)^n$$

This method is rarely used, however, and has the disadvantage, since it applies a constant rate of depreciation each year, that it cannot be used when the residual value is zero.

The book value year-by-year for these three different methods is shown graphically below. The book value in any given year is the initial cost less the accumulated total of the depreciation provision.



### 3.2.4 Financial provision

#### 3.2.4.1 General

As mentioned earlier accountancy provision in the usual sense is of little importance in municipal finance. What is important, however, is the financial provision that is made to cover the cost of capital plant. Although the City Treasurer may raise the necessary capital to finance a given project in a number of different ways, such as through public loans, short term bridging finance, contractor financing or leasing packages, or directly from revenue, the actual method of capital recovery or recharging to the particular project may be means of a completely different scheme. It is accordingly necessary to consider both aspects.

Since most municipal capital projects are funded by way of public loans the various methods of repaying loans will first be considered briefly. Similarly, although there are several different ways in which the capital cost can be recharged to the project, there are only two methods generally employed, namely the sinking fund method and the straight-line method (straight-line redemption by way of uniform instalments with interest charged on reducing balance).

#### 3.2.4.2 Repayment of loans

A sum of money borrowed may be repaid in any one of a number of different ways. The four most usual ones are the loan, annuity, straight-line and terminal repayment methods. See Appendix A.

The loan method is the one usually applicable to municipal loans. Interest on the loan is paid in periodic instalments, usually half-yearly, for the

duration of the loan, with the capital or principal being repaid in full at the end of the term. Capital repayment may be financed either through refinancing, namely a further loan issue, or by accumulating the necessary money in a sinking fund, either actual or notional. It is worth noting at this juncture that the interest rate on a sinking fund account does not necessarily have to match that of the loan issue. Since it is necessary to be reasonably certain that any sinking fund accumulation to meet future commitments will be available when required, it follows that sinking fund contributions must of necessity be invested in relatively safe sources, with unfortunately attendantly low interest rates.

The second method is the frequently employed annuity method. A typical example is the house mortgage bond. In this method the loan is repaid in equal periodic instalments, for instance monthly or annually, covering both interest on the balance of the loan outstanding and a capital redemption component. The annuity instalments are calculated from the standard expression, namely  $A = P/a^n$ .

The straight-line method is the third method employed. This method entails repayment of the principal in equal annual instalments with annual interest paid on the progressively reducing balance. The total repayments in respect of interest and redemption are accordingly higher in the earlier years, progressively decreasing towards the end of the term. This is the method that municipalities today generally adopt for the internal recovery of capital outlays on plant and equipment by way of annual capital charges against the respective departments. This aspect is considered further in section 3.2.4.3.

The final method is the terminal repayment one. This system entails no periodic instalments. The principal, with accumulated compound interest, is repaid in full at the end of the period in one single sum. This method is rarely used in business but is occasionally employed in the case of certain government loans, such as saving schemes.

It is important to note that from the economic point of view all four schemes are equivalent and in principle any one could be used in economic studies.

#### 3.2.4.3 Recharging of capital costs

As pointed out earlier recovery of the cost of a capital project is not necessarily by way of recharge to the project in the same manner as the loan is repaid. The reason for this is that to ease the burden of repayment, and in the case of revenue earning projects to match the income stream as far as possible, the debt is generally liquidated by means of periodic capital charge instalments, usually annually.

In any economic study, therefore, it is best to adhere to the charged system of repayment and not the actual method of repayment. In the case of municipalities this entails debiting the project with the annual charges raised by the City Treasurer. The profitability of the scheme should then be assessed on this basis. Exactly how the funding is arranged is the responsibility of the City Treasurer and there is accordingly little that the other municipal departments can do to influence this decision.

When the City Treasurer makes funds available to meet the cost of a capital project by another department, there are two ways of looking at the subsequent repayment. It can be considered either from the Council's overall point of view and the capital cost recharged against the project in strict accordance with the actual method of financing, or more parochially from the point of view of the department concerned in accordance with the specific method of recharging as determined and applied by the City Treasurer. Economically speaking the two methods are equivalent and either can be used; the same investment decision resulting in each case. The differences between these methods are only of consequence when considering the break-even point in discounted cash flow studies. This aspect is discussed later in section 4.3.3.

Reverting now to the various methods of recharging capital costs there are only two methods of any consequence worth considering, namely the annuity method and the straight-line method.

The annuity method of recharging capital costs is identical to the annuity method of repaying loans considered earlier in section 3.2.4.2. In this method the periodic annuity instalment is given by the standard expression, namely

$$A = \frac{P}{\frac{a}{nr}}$$

This instalment is the total capital charge and covers both interest and redemption. The interest component is the interest on the progressively reducing balance, the difference being the redemption component which similarly progressively and proportionately increases with time, each year's total capital charge remaining constant. See diagram at the end of this section and Appendix A.

Alternatively, and although not strictly correct when applying this method, the interest and redemption components can be looked at from the point of the loan (sinking fund) redemption method outlined in section 3.2.4.2 and depicted in Appendix C. In this case the interest and redemption components can be individually determined by making the following substitution in the above annuity equation.

$$r = \frac{1}{\frac{a}{nr}} - \frac{1}{\frac{a}{nr}} \quad (\text{equation (13)})$$

Then 
$$A = \frac{P}{\frac{a}{nr}} + Pr$$

The first term is the redemption or sinking fund component, namely the periodic sum that will accumulate with compound interest to the value of the principal. The second term is the interest component, namely the interest charge on the principal.

Example (23): Calculate the percentage capital charge, including the interest and redemption components, for a 15 year loan with interest at 10%, the loan being repaid on an annuity basis.

From equation (15) we have

$$\frac{1}{\frac{a}{nr}} = \frac{1}{\frac{a}{nr}} + r$$

$$r = 10\%$$

$$n = 15 \text{ years}$$

$$\therefore \frac{a}{nr} = 7,6061$$

$$\frac{a}{nr} = 31,773$$

$$\text{redemption component } (1/\frac{a}{nr}) = 3,1\%$$

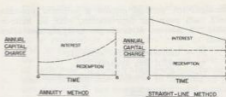
$$\text{interest component } (r) = 10,0\%$$

$$\text{capital charge } (1/\frac{a}{nr}) = 13,1\%$$

Consider now the straight-line method. In principle this is the same as the straight-line loan redemption method considered earlier. Redemption is charged in equal annual instalments with interest being charged on the progressively reducing balance.

It is the method generally followed by municipalities today rather than the annuity method that was in vogue some years ago. The reason for adopting the straight-line method is that it provides for relatively heavier repayments in the earlier years with progressive tapering off in the latter years. The annuity method on the other hand provides for equal instalments across the whole term. The straight-line method accordingly recovers capital costs in a manner that is closer to actual plant depreciation or the earning capacity of projects, which are both generally higher in the earlier years.

The differences between these two systems are shown graphically below.



## 4. ECONOMIC EVALUATION OF INVESTMENTS

### 4.1 General

The whole purpose of engineering economics is to facilitate the rational and logical choice between alternatives on a sound economic basis. Since the cash flows associated with investments, such as capital projects, are spread over a period of time, and since money has a time value, it is necessary to evolve an economic method of comparison that will adequately take these factors into account.

The obvious way to compare time differentiated cash flows is to bring them all to a common point in time either by discounting or compounding. If the cash flows are ahead of the reference point, which is known as "zero time", then they are discounted back to this common point; if behind in time they are compounded forward.

Several techniques have been developed to deal with this problem. In the past a number of rather crude methods, such as rate of return on capital employed and the pay-back method were extensively employed. Although these rather approximate methods are still used in certain quarters, the fashionable method of investment appraisal today is that known as "discounted cash flow".

Consideration will be given to the three most popular discounted cash flow techniques, namely the net present value (NPV), DCF yield and annuity methods, and a number of other related matters and their application to the economic evaluation of investments, particularly capital projects.

Capital projects may be divided into two broad categories, namely expansion projects and savings projects. The first group entails an expansion of activity while the second involves savings in operation, such as through substituting mechanical plant for manual labour. Each of these two main groups can be further subdivided into three other groups, namely development, renewal or reorganisation projects. All projects, however, no matter how classified, require a certain capital investment, usually at the outset, and entail a subsequent incremental net income stream (arising from either increased income in expansion projects, or decreased expenditure in savings projects). The capital investment cash flow is then related to the incremental net income cash flow stream attributable to the project by means of one or more of the various discounted cash flow techniques in order to assess the economic viability of the project.

In the private sector investment in more than one project can in general be contemplated depending upon the assessed profitability of the various projects and the availability of capital funds. In the public sector, however, the decision is usually whether to undertake a certain project in one or other of a number of different ways. In such cases the alternatives are said to be mutually exclusive since undertaking the venture in one way will exclude undertaking it in any of the others.

### 4.2 Cash flows

Although the meaning of the term cash flow is self evident it is necessary to consider one or two conventions to facilitate the use of the various discounting techniques.

The first step is to determine the reference point to which all cash flows will be referred, namely the point known as "zero time". This time can be either the present moment or, particularly in the case of large capital projects, the date the project is commenced, completed or commissioned. In the latter event the commissioning date is usually chosen since this is the point in time when the income stream from the project usually com-

mences and the project starts paying its way. The capital outlays over the construction period are then compounded forward to the commissioning date. The cost of the project computed in this manner is the total cost, including capitalised interest during construction. This aspect is dealt with further in section 4.10.

Having established the reference point, time is then counted either backwards or forwards from this point as illustrated diagrammatically below



The second convention relates to the sign of the various cash flows. The convention adopted is to assume all income as positive and all expenditure, including capital outlays, as negative.

A third convention concerns the point in time at which the various cash flows are assumed to arise. The convention here is to assume that capital outlays arise at the beginning of a period (for example, at the beginning of a year) and that the income and expenditure cash flows attributable to the project arise at the end of the respective periods (for example, year-end). Although year-end is the usual convention, others such as mid-year, start-of-year or continuous can, and frequently are, adopted. This aspect was considered earlier in section 2.11.

### 4.3 Methods of analysis

#### 4.3.1 General

As mentioned earlier it is proposed to deal only with the three main discounting methods, namely the net present value (NPV), DCF yield and annuity methods. All these methods involve the employment of the various compounding and discounting techniques discussed earlier in the paper. The relationships and differences between these various methods will be considered briefly and one or two related matters dealt with.

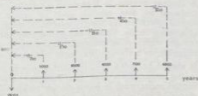
#### 4.3.2 Discounted cash flow

Although the general expression covering these three methods refers to discounting, the opposite operation, namely compounding, is frequently involved. In both cases the respective cash flows are either discounted back or compounded forward to the reference point, namely zero time. In this manner the time element is correctly taken into account and each and every cash flow element is effectively converted to an equivalent amount at a common point, namely zero time. These equivalent values, known as the discounted values or "present values", can then be summed algebraically to obtain the equivalent total present value, known as the discounted values or "present values", can then be summed algebraically to obtain the equivalent total present value, known as the "net present value".

#### 4.3.3 Net present value (NPV) method

This method of discounting all cash flows to a common point and then algebraically summing them to obtain the so-called net present value (NPV) is the first of the three discounting techniques. Its method of application is perhaps best illustrated by way of an example.

Example (24): Calculate the net present value of a capital project entailing an initial outlay of R13 000 and which will generate a net annual income stream over five years as illustrated diagrammatically below. Interest is at 10% per annum and scrap value is assumed to be nil.



The present value (PV) of each year's net income is obtained by discounting the respective amounts to zero time by multiplying by the relevant value of  $v$  in each case, as follows.

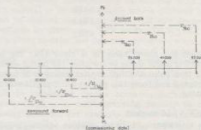
PV 1st year's income	=	5 000	•	0,9091	=	4 546
" 2nd "	"	6 500	•	0,8264	=	5 372
" 3rd "	"	4 200	•	0,7513	=	3 155
" 4th "	"	7 100	•	0,6830	=	4 849
" 5th "	"	6 800	•	0,6209	=	4 222
" total income stream					=	22 144

For an initial outlay of R13 000 the present value of the resulting net income stream is R22 144. The net present value of this project is the algebraic sum of the capital outlay and the present value of the income stream, namely 22 144 - 13 000 = R9 144.

It is most important to note the meaning and significance of this net present value. It is effectively the present value equivalent of the profit that this project will generate over its five year life. In other words, it is equivalent to a capital gain or profit as yet unrealised.

The method of treating capital outlays arising before zero time is illustrated by the following example.

Example (25): A capital project entails capital outlay in the three years prior to commissioning. After commissioning a net income stream as indicated will arise. Assuming no scrap value and interest at 10% per annum, calculate the net present value of this project, as illustrated below.



As before, each cash flow after zero time is discounted back in time by multiplying it by its respective value of  $v/n^t$ . Each cash flow before zero time is compounded forward by multiplying it by the reciprocal of its respective value of  $v/n^t$ , namely  $1/v/n^t$ , as follows.

Present value of capital outlay flow (P<sub>1</sub>) is calculated by compounding forward, as follows.

10 000	•	1,3310	=	13 310
12 500	•	1,2100	=	15 125
16 800	•	1,1000	=	18 480
∴				
P <sub>1</sub>	=	46 915		

Present value of the net income stream (P<sub>2</sub>) is calculated by discounting back, as follows.

35 000	•	0,9091	=	31 819
41 000	•	0,8264	=	33 882
53 000	•	0,7513	=	39 819
∴				
P <sub>2</sub>	=	105 520		

The net present value of the project is therefore 105 520 - 46 915 = R58 605.

The above examples are relatively simple ones to illustrate the principle involved. In more complex cases it is often useful to know how long it will take before the accumulative net present value of the net income stream

equals the total capital outlay and the project starts showing a profit. This point is determined by calculating the accumulative net present value year-by-year. The break-even point is where this accumulative net present value equals zero.

As referred to in section 3.2.4.3 this break-even point is influenced by the capital recovery or repayment system adopted. In other words, the time required for the accumulative net present value of a cash flow series to equal the initial capital outlay will depend upon the repayment system adopted. Any system that entails heavier repayments in the earlier years will result in a longer time to break-even than will a system in which the converse applies. The reason for this is that because of the larger repayments (negative cash flows) in the earlier years, it will take longer for the income stream (positive cash flows) to offset these repayments. In the two other discounted cash flow methods, namely the DCF yield and annuity methods, the recharge method is of no economic consequence since the time to break-even is not involved in these calculations.

Example (26): Consider the data in example (24) above and determine the break-even point.

The relevant information and the method of obtaining the progressive accumulative net present value (NPV) is as follows.

Year	Capital outlay	Present value of net income	Accumulative net present value
0	(-) 13 000		(-) 13 000
1	—	4 546	(-) 8 454
2	—	5 372	(-) 3 082
3	—	3 155	73
4	—	4 849	4 922
5	—	4 222	9 144

From the above table it is clear that the break-even point is about three years after the initial capital outlay. At this point the full capital outlay will have been recovered and from this point on the profit starts accumulating.

#### 4.3.4 DCF yield method

In the NPV method an interest rate was assumed and the net present value of the cash flows determined. The DCF (discounted cash flow) yield method is a variation of the NPV method. Instead of assuming an interest rate the rate is calculated which will result in a net present value of zero at the estimated end of the project's economic life. In other words, the interest rate is computed which will result in the project just breaking even at the end of its economic life. This interest rate is known as the DCF yield.

This method has certain advantages. No decision has to be taken as to what the appropriate interest rate should be, as in the NPV method. All that has to be done is to decide whether there is sufficient margin between the DCF yield and the firm's estimated cost of capital (interest rate) to justify the risks and uncertainties involved.

When applying this method to a project where the capital outlay is spread over a number of years, as in one of the previous examples, zero time is taken as the time of the initial capital outlay. All other outlays are considered as part of the subsequent cash flows, the capital outlays being negative and the incomes positive. It is possible that some of the net cash flows could be negative. As long as all the negative net cash flows occur before the positive net cash flows, a single correct and unambiguous DCF yield will result. But if negative net cash flows, particularly heavy ones, occur after positive net cash flows, then there can in general be more than one value of DCF yield that will satisfy the given conditions. In such an event the solution is ambiguous and has no real meaning. In practice, though, such cases rarely occur, particularly not in straight-forward engineering calculations. There is, however, a technique to deal with such cases, but it will not be considered here because of space limitations.

In calculating DCF yields there is no simple formula that will give the yield directly. It is necessary to make

one or two trial calculations using different yield figures until by successive approximations two are found that straddle the zero net present value point. The exact figure can then be found by extrapolation. In more complex problems computers or advanced scientific calculators can be programmed to undertake this calculation by successive approximation.

Example (27): Consider a cash outlay of R2 100 and positive net cash flows over four years as indicated diagrammatically below. Calculate the DCF yield.



By one or two trial calculations it is apparent that the DCF yield lies between 14% and 15% per annum. The various figures can then be presented in tabular form as follows.

Year	Net cash flow (R)	14 % Discount rate		15 % Discount rate	
		Discount factor	Discounted cash flow (R)	Discount factor	Discounted cash flow (R)
0	(-) 2 100	1,0000	(-) 2 100	1,0000	(-) 2 100
1	1 000	0,8772	877,2	0,8696	869,6
2	700	0,7664	536,48	0,7561	529,27
3	800	0,6750	540,00	0,6575	526,00
4	1 000	0,5921	592,10	0,5718	571,80
Net present value			10		(-) 35

The difference in NPV between the two interest rates is 48. By extrapolation, therefore, the DCF yield is calculated as follows.

$$\text{DCF yield} = 14 + \frac{48}{85} \cdot 1 = 14,56\%$$

#### 4.3.5 Annuity method

The third discounted cash flow method is the annuity or annual charge method. This method, like the DCF yield method, is also a variation of the NPV method.

In the annuity method every capital outlay is converted to an equivalent annuity and the resulting uniform annual cash flow, known as the "annual capital charge", is added algebraically to all other annual charges of both the income and the expenditure streams. If the resulting net annual charge is positive then the project will be profitable; if negative it will not.

Alternatively, the annual capital charge may be compared to the annual net cash flow of the income and the expenditure streams. If this annual net cash flow is positive and exceeds the annual capital charge, then the project is acceptable; otherwise it is not.

The annuity method was popular some years ago and was employed extensively in the public sector, particularly by government departments and municipalities. The reason for this is that most public sector projects give rise to fairly constant annual net cash flows and as such lend themselves to treatment by this method. A further reason is that such projects are generally financed by debt capital, such as public loans, with formal provision for the redemption of capital by means of sinking funds. This is not necessarily the case today though where most municipalities allow for capital recharging on a straight-line basis (see section 3.2.4.3).

It should be noted that implicit in the annuity method is the assumption that provision for depreciation or capital recharging is based on the sinking fund method discussed earlier (see section 3.2). If depreciation provi-

sion, or capital recharging in the case of the public sector such as municipalities, is not on a sinking fund basis, then this method will not necessarily reflect correctly the actual situation, particularly in intermediate years.

Although in principle the annuity method is based on comparing the annual capital charges of a single capital outlay with a uniform annual net cash flow, it can readily be extended to those cases where there may be more than one capital outlay and the net cash flow stream is not uniform but irregular. In such cases, by using standard compounding and discounting techniques, all capital outlays can be converted first to an equivalent single sum at zero time and then expressed as an equivalent annual capital charge using the standard relationship ( $A = P/a$ ). Similarly, the irregular net cash flow stream is also converted to a single sum at a common time, usually zero time, and then converted back to a single equivalent annuity. These two equivalent annuities are then compared to determine whether or not the project is profitable and hence acceptable. If the difference between these two equivalent annuities is determined, then it is apparent that this method is nothing more than the NPV method with the NPV expressed as a single equivalent annuity.

Example (28): It is proposed to install certain plant in a factory at a cost of R12 000 which will reduce labour costs by R2 800 a year. The installation of this plant is expected to increase operating costs by R980 a year on account of electrical power and maintenance. The plant is estimated to have a useful life of 10 years and a scrap value of R1 500. Determine the profitability or otherwise of this proposal by means of the annuity method. Interest may be taken as 9% per annum.

As seen in section 3.2.2 on depreciation provision there are four different but equivalent formulae giving the annual capital charge. The most usual of these is equation (49) which expresses the annuity as the sum of the sinking fund contribution plus interest on capital, as follows.

$$A = \frac{P(1+i)^n}{i} + Cr$$

$$C = 12\ 000$$

$$S = 1\ 500$$

$$i = 10\ \text{years}$$

$$r = 9\ \% \text{ per annum}$$

$$i_n = 15,1929$$

$$A = \frac{(12\ 000 - 1\ 500)}{15,1929} + (12\ 000 \cdot 0,09)$$

$$= 691 + 1\ 080$$

$$\therefore \text{Annual capital charge} = R1\ 771$$

Consider next the annual cash flows of income and expenditure. Note that the labour saving is effectively an income item since it reduces expenditure. The annual net cash flow may then be determined as follows.

Labour savings	= R2 800
Electrical power and maintenance	= 980
$\therefore$ Annual net cash flow	= R1 820

The advantage in favour of proceeding with this project is the difference between the positive annual net cash flow of R1 820 and the plant annual capital charge of R1 771, namely R49 per annum. It is also of interest to note that the annual capital charge of R1 771 is made up of the sinking fund contribution of R691, to cover the depreciable portion of the cost of the plant, and the loss of interest on the initial capital, namely R1 080.

#### 4.3.6 Comparison of discounting methods

Of the three main discounting methods, the annuity or annual capital charge method is the one that it probably best known to engineers. It has been used for many years in the analysis of civil, mechanical and electrical engineering projects, mainly in the public sector. In most cases its application is straight-forward and the results are reliable and consistent with those of the other two discounting methods. In relatively simple cases the other two methods, namely the NPV and DCF yield methods, will also give equally reliable and consistent results. In these straight-forward cases, either of the three methods will lead to the same investment decision.

In more complex problems it is usually necessary to resort to either the NPV or the DCF yield method. But these two methods do not always give apparently consistent results and unless care is exercised in the interpretation of the results, a wrong decision could well be taken. This applies not only to complex problems but also to relatively simple ones as well. This ranking difficulty is usually more evident in the case of mutually exclusive projects.

No one method of the three is the best, despite what different authorities may say. Each method has its exponents, with some favouring one and others another. The best method for any particular project depends largely on individual circumstances. Frequently two methods have to be employed to enable a correct decision to be taken.

#### 4.3.7 Mutually exclusive projects

There is usually no difficulty in dealing with projects when capital is freely available and a decision has been taken to embark on all projects that are deemed to be acceptable by either the NPV or the DCF yield method. Difficulties in selection do arise, however, when projects are mutually exclusive, namely when a number of alternatives are competing to meet a given objective.

There are two general situations to consider. The first and most usual is where increasing capital outlays result in increasing income streams, such as the case of extensions to a manufacturing facility to meet increasing demand, for example. The second is where increasing capital outlays result in decreasing expenditure streams. A typical case here is the economic selection of cable size, namely Kelvin's law.

Consider the first situation where progressively increasing outlays on alternative projects lead to progressively increasing income streams. In these cases the alternative with the lowest capital cost is selected as a reference point or base and the increments in capital outlays and income of all other alternatives relative to this base are determined. In addition to compiling the NPV and DCF yield of each alternative in the normal manner, the corresponding values of the incremental series are also similarly calculated. Selection is then based on successive consideration of both the individual NPV's and DCF yields of the various alternatives as well as the corresponding incremental series. The technique employed is best illustrated by way of an example.

Example (29): Consider two alternative but mutually exclusive projects to meet a certain need. Alternative (A) costs R42 000 and results in a net cash flow of R8 300 per annum while Alternative (B) costs R65 000 and generates a net cash flow of R12 000 per annum. Both projects have a life of 10 years with no scrap value. The firm's cost of capital is 9% per annum. Determine the best project.

The NPV and DCF yield of each alternative and the incremental cash flow series are calculated in the standard manner. The results are tabulated below.

Project	Capital Cost (R)	Net cash flow (R/annum)	NPV (R)	DCF yield (%)
A	42 000	8 300	11 267	14,8
B	65 000	12 000	12 012	13,1
B-A	23 000	3 700	745	9,7

On the basis of NPV it would appear that (B) would be the best choice since it has a higher NPV. On the basis of DCF yield, though, the converse appears true, namely (A) would appear preferable since it has a higher yield than (B). The difficulty here arises because the alternatives have different capital costs and cash flows and the DCF yield method does not recognise this difference in money terms. In the example, although (A) has the higher yield, namely 14.8%, this yield relates to a capital cost lower than that of (B), while the converse applies when considering (B). The way out of this dilemma is to consider the incremental series, namely (B-A). For an additional outlay of R23 000 an increase in cash flow of R3 700 per annum will arise equivalent to a NPV of R745. As this NPV is positive it might at first sight be thought that this additional outlay is warranted. But the DCF yield on this incremental capital outlay is only 9.7% which is very close to the firm's cost of capital. In a completely risk free situation this yield would be acceptable and (B) would be chosen. But most actual situations are not risk free and the margin of a mere 0.7% over the cost of capital would generally not be sufficient to justify the acceptance of (B). In these circumstances (A) would be chosen.

The important point to note when considering mutually exclusive projects such as this, is that it is not sufficient to look at NPV's and DCF yields alone. The incremental NPV's and DCF yields must also be considered.

In the second situation, where increasing capital outlays result in decreasing expenditure streams, the method of treatment is different. Since in this situation increasing capital outlays result in decreasing expenditure cash flows we have an inverse relationship. The general solution to this type of problem is as follows.

Let  $y$  = total cost

$x$  = variable cost element

then  $y = ax + b/x + c$  ( $a, b$  and  $c$  are constants)

Because of the inverse relationship the standard method of treatment is to differentiate this expression and equate it to zero to obtain the minimum cost point.

Hence,  $dy/dx = a - b/x^2$

Equating to zero and rearranging we have

$$x = \sqrt{\frac{b}{a}}$$

Substituting this value of  $x$  for the minimum cost in the first equation we have

$$y = \sqrt{ab} + \sqrt{ab} + c$$

In other words, at the minimum cost point the directly varying cost ( $ax$ ) equals the inversely varying cost ( $b/x$ ) with both being equal to  $\sqrt{ab}$ . This is the relationship on which Kelvin's law is based. Kelvin's law is considered in section 5.5.

#### 4.4 Interest rate

One of the most difficult decisions in engineering economic studies is to determine an appropriate rate of interest to use in discounted cash flow studies. The matter is not as simple as it might seem and there is considerable divergence of opinion as to what the correct rate should be in any given set of circumstances.

Although the underlying principles involved are generally common to both the private and the public sector, difficulties do arise due to differences in funding and because of tax considerations. Basically though any project can be financed by way of funds from two sources, namely equity funds or borrowed funds. Equity funds are supplied by the shareholders or owners of the business. In the municipal context these are the ratepayers or electricity consumers. Borrowed funds are funds obtained from external sources and may be either short, medium or long term. In the municipal context they are not necessarily derived directly from the ratepayers but from the public at large.

Consider now the municipal situation. If a project is financed from current income, namely from Revenue Account, the view is held in certain quarters that this money is free and that no interest rate need accordingly be charged. This is completely wrong. The correct rate to employ in this situation is the so-called "opportunity cost", namely the interest rate on the alternative investments foregone by the ratepayers or the electricity consumers. If these funds had not been obtained from the ratepayers or the consumers through direct taxation by way of rates or the electricity tariff, this money would have been available to the individuals for personal investment elsewhere. To the man-in-the-street, this opportunity cost is currently probably in the region of 8% to 10% per annum net of tax.

On the other hand, if a project is funded by way of loan funds, namely on Capital Account, then the appropriate rate can be either the weighted average cost of loan funds to the municipality or the current new loan rate, namely the marginal or incremental rate. There is, however, considerable controversy as to whether the average or the marginal rate should be adopted. Generally speaking the average rate is deemed to be the correct one for run-of-the-mill municipal projects. Larger projects undertaken by trading services, such as electricity and water undertakings, particularly the former, can justifiably be charged the marginal rate. But this is fine as long as marginal rates are higher than the average rate of the relevant capital development fund. But what would happen if interest rates should drop drastically one day and the marginal rate fall below the average rate? Strictly speaking and to be consistent this lower marginal rate should be applied, but in practice there would be the temptation to levy the higher average rate! At the moment, though, municipal average rates are probably around 6% to 7% with marginal rates around 12% to 13% per annum.

It is also argued by certain authorities that the interest rate in the case of borrowed funds should not be the bare cost of such funds but a higher figure. Some authorities consider a 2% to 3% margin desirable. The argument hinges basically on opportunity costs in a capital rationing example, a municipality because of limitations in the availability of funds, may not be able to undertake all proposed schemes deemed to be profitable. Acceptance of a project with a low yield or rate of return would preclude acceptance of a project with a higher rate of return. It could then be argued that the appropriate interest rate to employ should be this higher rate of return on the investment opportunity foregone.

It may be concluded, therefore, that in general terms the appropriate rate of interest to employ in discounting studies is the minimum rate of return that is attractive in the particular circumstances. In the public sector this could well be the opportunity cost of the displaced private spending.

#### 4.5 Risk and uncertainty

Very few if any capital investment projects can be claimed to be completely risk free. It is merely a question of degree. In addition to the element of risk there is also the closely allied problem of uncertainty. The outcome of investment decisions cannot in general be predicted with any degree of certainty.

Because of the risks and uncertainties inherent in any investment decision it is necessary to consider how those factors can be taken into account in the various discounted cash flow techniques.

One method frequently employed is to consider limits to the variables and by means of so-called sensitivity studies and probability factors, determine the most likely outcome. Alternatively, calculations can be undertaken for upper, lower and mean values to determine the likely spread.

A further possibility is to increase the interest rate employed in the analysis to cover the estimated risks and uncertainties. A further and related possibility in the case of the DCF yield method, is to allow appropriate margins between the computed DCF yield and the minimum attractive rate of interest. As a general guide the

extent of the margins generally allowed are of the following order.

Investment	DCF yield above interest rate (%)
marginal	0—1
acceptable	1—2
attractively acceptable	2—3
generally acceptable	3—6
highly acceptable	over 6

For example, if a particular project indicates a DCF yield of 14% per annum and the firm's minimum attractive rate of return or interest rate is 9% per annum, then the margin is 14—9 = 5%. From the above table this is seen to be a "generally acceptable" project.

#### 4.6 Deferred investments

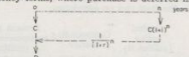
A frequent problem in investment analysis is to determine whether a given project should be undertaken now or deferred for a number of years; or whether plant of minimum capacity should be installed so as just to meet the short-term demand, and then expanded later when the demand increases. Alternatively, should plant of maximum capacity be installed initially?

The method of determining whether or not a project should be deferred in the face of inflation and changing price levels is based on the technique illustrated in section 2.12.

Let  $C$  = capital cost in first year (zero time)  
 $r$  = interest rate: money terms (namely, with inflation)  
 $i$  = escalation in plant cost: money terms  
 $f$  = inflation rate (namely, increase in general price level, or decrease in purchasing power of money)

Also, as in the analysis in section 2.12, let the above symbols with a dashed suffix represent the corresponding values in real terms (namely, net of inflation).

Consider the following diagram, with values expressed in money terms, where purchase is deferred in years.



$$P = \frac{C(1+i)^n}{(1+r)^n}$$

If  $P$  is less than  $C$  then it will pay to defer expenditure, otherwise not, namely if

$$P < C$$

$$\text{i.e. } \frac{C(1+i)^n}{(1+r)^n} < C$$

$$\text{i.e. } i < r$$

Consider next the relevant expressions in real terms. The future cost  $C(1+i)^n$  in money terms is converted to its real terms equivalent by dividing by  $(1+f)^n$ , as before (see section 2.12). This future sum in real terms is then discounted back to the present at the real rate of interest ( $r'$ ).

$$\text{Then } P = \frac{C(1+i)^n}{(1+f)^n} \cdot \frac{1}{(1+r')^n}$$

$$\text{But } (1+i') = \left(\frac{1+i}{1+f}\right) \quad (\text{see section 2.12})$$

$$\therefore P = \frac{C(1+i')^n}{(1+r')^n}$$

Therefore, as before, it will pay to defer expenditure if  $i' < r'$

$$\text{Note that } (1+r') = \left(\frac{1+r}{1+f}\right)$$

$$\text{and } (1+i') = \left(\frac{1+i}{1+f}\right)$$

If the values of  $r$  and  $f$  are relatively small, as they generally are in practice, then

$$r' \approx r - f$$

$$\text{and } i' \approx i - f$$

In general, therefore, it is evident that if

$$1 < r' \text{ (or } i' < r'), \text{ then defer expenditure}$$

$$1 = r' \text{ (or } i' = r'), \text{ indifferent}$$

$$1 > r' \text{ (or } i' > r'), \text{ acquire now}$$

Example (30): A decision is required as to whether a certain item of plant should be purchased now or its acquisition deferred for four years. The escalation in plant price is estimated to be 13% per annum. The interest rate is 11% per annum and the general price level is expected to rise at 10% per annum.

$$r = 11\% \quad r' \approx 11 - 10 = 1\%$$

$$f = 10\%$$

$$i = 13\% \quad i' \approx 13 - 10 = 3\%$$

$$\therefore 1 > r' \quad i' > r'$$

Since the rate of escalation in plant cost (in either money or real terms) is greater than the interest rate (correspondingly either in money or real terms) it would clearly pay to acquire the plant now and not defer expenditure.

#### 4.7 Incremental and sunk costs

It is most important to bear in mind at all times that it is prospective differences between alternatives that are important in economic studies and not the actual values of the alternatives themselves. The actual values of the various alternatives are not of any real relevance — it is the differences between them that are important. Hence, all economic studies are based on differential or incremental costs.

Also, in all studies we are looking ahead to the future, not back into the past. Hence, what is important are the changes in the future, what happened in the past cannot influence a future decision in the economic sense. All costs in the past, which are generally referred to as "sunk costs", are quite irrelevant in discounted cash flow studies.

Example (31): A firm pays a 10% deposit on an item of plant costing R5 000 to be ordered from overseas. After placing the order it finds that an equally good item costing R4 200 can be obtained locally ex stock. Ignoring any advantage attributable to earlier delivery should the firm purchase this local unit or not?

Having paid a R500 deposit it may be thought better to purchase the first unit rather than lose the deposit. But the deposit is a sunk cost and as such is quite irrelevant to any future decision. The decision rests on either paying the R4 500 still owing on the first unit or R4 200 for the second unit available locally. The correct economic decision is therefore to purchase the second unit locally at R4 200 and forego the deposit.

#### 4.8 Alternatives with different lives

Difficulties can arise in economic studies when considering alternative projects that have different lives. The correct approach in such cases is to relate all cash flow series to a common life, generally that of the required service. The assumption here is that the required service life is longer than the project lives of the individual alternatives. As each project is retired another is assumed to take over, the process being repeated serially to the end of the assumed service life. Depending upon the particular circumstances of each case it is generally acceptable to assume the economic service life to be the lowest common multiple of the lives of the respective alternative projects. For example, if one alternative has a life of 4 years and another 6 years, then the economic service life can be taken as 12 years. This will permit three full cycles of the one alternative and two of the other. Although not all practical cases permit such an artifice to be adopted, it is nevertheless a useful simplifying assumption to illustrate the principle involved.

The NPV and DCF yield methods can be based on this principle of cycling the individual project lives over a

given common service life. In the case of the annuity method, however, it is not really necessary to determine a common service life if it is assumed, as is often the case, that all projects cycle with the same cost structures, namely that the initial and residual costs of each project are assumed to repeat themselves in each serial replacement. With this simplifying assumption it is then only necessary to determine the annual charge of each alternative in the normal manner.

Example (32): Determine which of the following two alternatives is the more economic, assuming an interest rate of 10% per annum.

	(A)	(B)
Initial cost (R)	20 000	35 000
Residual value (R)	4 000	8 000
Life (years)	15	25
Annual operating costs (R)	3 200	1 800

Using the annuity method the annual capital charge is given by the following expression (equation (56)).

	(A)	(B)
Share	$C = 20\ 000$	$35\ 000$
	$L = 4\ 000$	$8\ 000$
	$n = 15$	$25$
	$r = 0,10$	$0,10$
	$s_{10} = 31,77$	$38,35$
∴ annual capital charge (A)	$= 2\ 504$	$3\ 775$
annual operating cost	$= 3\ 200$	$1\ 800$
total annual charge	$= 5\ 704$	$5\ 575$

The project with the highest initial capital cost (R35 000) has the lowest overall annual charge (R5 575) and this alternative is therefore the more economic of the two.

#### 4.9 Capitalised cost

This is an expression that is frequently used in engineering economics and it is just as well to be quite clear as to what is meant by this term. In the sense that it is normally used it is taken to mean the equivalent value of a cash flow series discounted or compounded to a common date. This equivalent value is known as the "capitalised" value.

A typical example is the capitalisation of transformer losses. In this case the cash flows representing the annual cost of the losses are discounted to the present. For comparative purposes in the adjudication of tenders this capitalised cost is added to the actual cost of the transformer to obtain an overall comparative price.

Example (33): Tenders have been received from two firms for a 40 MVA 132/11 kV transformer. The respective capital costs and annual cost of the losses are as scheduled below. Assuming a life of 30 years, and interest at 11% per annum, determine which transform.  $r$  is likely to be the more economic overall.

	A	B
Tender price (R)	295 000	310 000
Annual cost losses (R)	9 700	7 100

The capitalised value of the losses is obtained from the standard expression.

$$P = \frac{L}{r}$$

	A	B
∴ Tender price (R)	295 000	310 000
Capitalised cost of losses (R)	84 300	61 700
Total comparative price (R)	379 300	371 700

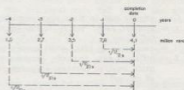
The transformer having the highest initial cost is therefore likely to be the most economic overall.

The above example is a simple one merely to illustrate the principle involved. In practice the position is more complex, particularly when cyclic loading, growth and inflation are taken into account. A technique for dealing with this sort of case is considered in section 5.

#### 4.10 Capitalised interest during construction

Because of the relatively high interest rates experienced in recent years it has become fashionable to capitalise interest during construction on a project the cost of which is spread over several years in order to obtain the economically correct overall capital cost. Because of the time value of money it is clearly incorrect to add arithmetically costs that are dispersed in time. The method employed is to compound the individual capital outlays at the relevant interest rate to the time of the last capital outlay before the net cash flows begin, usually the commissioning date, and to look upon this accumulated total as the single equivalent capital outlay at this date.

Example (34): The construction of a large capital project is expected to take five years to complete with expenditure phased over this period as indicated diagrammatically below. Calculate the capitalised cost of the project on completion assuming interest at 9% per annum.



In this problem we compound forward as indicated to obtain the final cost on completion.

Year	Capital outlay (million R)	Compounding factor	Present value at commencement rate (million R)
-4	1,5	1,412	2,12
-3	2,7	1,295	3,50
-2	3,5	1,188	4,16
-1	7,8	1,090	8,50
0	4,1	1,000	4,10
Final capitalised cost			22,28

Although the arithmetic total of the capital outlays over the five year period is R19,6 million the capitalised cost on completion is R22,4 million. The difference of R2,8 million is the capitalised cost of interest during the construction period.

### 5. ELECTRICAL LOSSES

#### 5.1 General

Losses in electrical plant feature prominently in engineering economic studies. The cost of these losses can be taken into account by employing any of the discounted cash flow techniques considered earlier, particularly the NPV and annuity methods. When using the NPV method the cost of the losses are capitalised and added to the first cost of the plant to obtain an overall comparative capitalised price. In the annuity method the first cost of the plant is expressed as an equivalent annual charge and added to the annual cost of the losses to obtain the total annual charge for comparative purposes. The later method is satisfactory in simple cases where the annual cost of the losses are constant from year to year. But when growth and inflation are taken into account it is considered better to use the NPV method. If required, though, the net present value can in turn be converted to an equivalent annuity.



There are two general types of losses in electrical plant, namely variable and fixed. The variable losses are those that are a function of the load current, principally the series load losses. The fixed losses comprise those losses that are a function of the voltage, namely the hysteresis, eddy-current and shunt load losses, known collectively as the iron losses, and dielectric and corona losses; and the mechanical losses, namely friction and windage. The losses of principal interest are the series load losses and the iron losses, referred to loosely as the load losses and iron losses respectively.

The fixed losses are readily dealt with in economic studies, being directly proportional to the time the plant is connected. The variable losses, however, being a function of the load current, necessitate taking into account the loading of the plant. Further attention will accordingly be confined to these variable or load losses.

### 5.2 Load losses

The variable nature of the load is taken into account by means of the so-called loss load factor. This factor is the ratio of the actual energy loss to the energy loss that would be sustained if the plant were to run at its peak operating load for the full connected time. This loss load factor is a function of the load factor and several empirical relationships have been developed, the most popular being the following.

$$L = 0,3 \ell + 0,7 \ell^2$$

where  $L$  = loss load factor

$\ell$  = load factor

The peak operating load need not necessarily equal the rated load of the plant. For example, when two cables are operated in parallel it is customary to limit the peak current in each to half the rating to ensure a firm capacity equal to the rating of one cable. This loading condition is taken into account by introducing a demand factor, as follows.

The annual cost of the load losses can then be determined from any one of the following standard relationships.

$$\begin{aligned} A &= (m + uTL) \ell \\ &= (m + uTL) \ell^2 R \\ &= (m + uTL) k^2 \ell^2 R \\ &= (m + uTL) k^2 \end{aligned}$$

The application of these formulae to three typical cases will now be considered, namely transformers, motors and cables.

### 5.3 Transformers

In the case of transformers it is customary to express the annual cost of the load losses per kW of the rated full load losses, as follows.

$$A = (m + uTL) \cdot k^2$$

This value of the annual cost of the load losses may be converted to its equivalent capitalised value (P) in the normal manner, as follows.

$$P = A \cdot a_{\overline{n}|r}$$

The above formulae are the ones usually employed in capitalising load losses and are based on discrete year-end compounding. But it can also be argued that as the losses are occurring continuously, it would be more correct to apply the continuous compounding formula to take account of this fact.

For discrete compounding we have

$$P = A \cdot a_{\overline{n}|r} = A \cdot \left[ \frac{1 - (1+r)^{-n}}{r} \right]$$

For continuous compounding we have

$$P = A \cdot \left[ \frac{1 - e^{-nr}}{r} \right]$$

A further point to note is that the above formulae for the capitalised value of the losses are based on a constant cost of electricity and a constant peak load (reflected by k).

Both load growth and escalation in the cost of electricity, however, can and should be taken into account. A suitable technique is outlined in section 2.12 and appropriate formulae can be developed for different loading conditions and circumstances. For example, the formula for the simple case of escalation in the cost of electricity and no growth in load can readily be derived, as follows.

$$P = \frac{A}{(1+i)} \cdot a_{\overline{n}|i}$$

where  $i$  = inflation rate in cost of electricity  
 $r$  = interest rate  
 $d = \left( \frac{1+r}{1+i} \right) - 1$

The above formula is based on a single annual payment ( $p=1$ ). Consider now the case of distributed annual payments and continuous compounding. If the cost of electricity is assumed to increase once a year, as would be the case in practice, but with the cost of the losses compounded continuously, then for this case it can similarly be shown that

$$P = \frac{A}{(1+i)} \cdot \left( \frac{e^r - 1}{r} \right) \cdot a_{\overline{n}|i}$$

where  $d = \left( \frac{e^r}{1+i} \right) - 1$

The application of these various formulae is best illustrated by way of an example.

Example (35):  $m = R70,00$  /kW per annum (based on  $R7,30$ /kW per month for 12 months and a reduction factor of approximately 0,80)

$$u = 1,06 \text{ cents/kWh}$$

$$T = 8\,760 \text{ hours (connected for full year)}$$

$$L = 0,25$$

$$k = 0,50 \text{ (half full load rating)}$$

$$\begin{aligned} \therefore A &= (m + uTL) \cdot k^2 \\ &= \left( 70,00 + \frac{1,06 \cdot 8\,760 \cdot 0,25}{100} \right) \cdot (0,50)^2 \\ &= 23,30 \text{ Rand/kW rated full load series load} \end{aligned}$$

also  $r = 9\%$  per annum losses

$$i = 8\%$$
 per annum

$$n = 30 \text{ years}$$

Then applying the above formulae for both discrete and continuous compounding, with and without inflation, the capitalised values of the load losses can be computed, as follows. The figures are expressed in rand/kW of full load series load losses.

compounding method	no inflation	with inflation
discrete	239	563
continuous	241	557

From a study of the above figures it is clear that there is little difference between the values for discrete and continuous compounding. In practice, therefore, it is generally quite adequate to apply the formulae based on discrete annual compounding.

Escalation in the cost of electricity, however, does have a major influence on the capitalised value of the losses and should accordingly always be taken into account.

Using the techniques previously outlined the effect of load growth on capitalised costs can also be taken into account, along with inflation, although in practice the formulae become a little more complex, particularly where the load grows to a certain level and then remains constant for the rest of the economic life.

In example (35) above the load was taken to be 50% of the transformer rating. If it is now further assumed that this initial peak load grows at a rate of 6% per annum until it reaches full load, namely 100% of the rating (after about 12 years) and then remains at this level for the rest of its 30 year assumed life, then it can be shown that the capitalised cost of the losses will increase to a value of 1 783 Rand/kW. The derivation of the relevant formula for this special case is not given here because of space limitations.

In dealing with these complex cases involving growth and inflation the effective capitalisation factor can be expressed as the standard value for no growth or inflation. From a study of the above figures it is clear that there example the  $B$  factor is 7.46. Hence  $239.7.46 = 1 783$ , as above.

The above analysis indicates how important it is to make reasonably accurate assumptions not only in respect of interest rates and loading patterns, but also for load growth and inflation. These are factors which are frequently ignored when capitalising transformer losses but which nevertheless clearly have a significant impact on the result and should accordingly be taken into account.

#### 5.4 Motors

The capitalisation of motor losses can be undertaken in a similar manner to that for transformers. An alternative approach, however, and one frequently adopted, is to base the economic analysis on efficiency. This method incidentally inherently takes into account both the load losses and the no-load losses.

Let

$$W_i = \text{input power}$$

$$W_o = \text{output power}$$

$$W_L = \text{losses}$$

$$\eta = \text{efficiency}$$

$$= \frac{W_o}{W_i} \quad (\text{by definition})$$

$$\lambda = \text{loss ratio}$$

$$= \frac{W_L}{W_o} \quad (\text{by definition})$$

Then using the same terminology as before, we have

$$A = (m + uLr) \cdot \lambda W_o$$

$$P = A \cdot a_{nr}$$

The above formulae can also be modified, as before, to take into account inflation. A simple example will illustrate the method.

Example (36): A choice is to be made between two 75 kW motors, the relevant capital costs, efficiencies and

other data being as follows. Full load operation 10 hours a day on 15 days in each month may be assumed.

$$m = 27.30 \text{ per kW per month (namely 270.00 per annum, no failure)}$$

$$u = 1.06 \text{ cents/kWh}$$

$$T = 1 800 \text{ hours}$$

$$L = 1.00$$

$$r = 9\% \text{ per annum (interest rate)}$$

$$i = 7\% \text{ per annum (electricity tariff inflation rate)}$$

$$n = 25 \text{ years}$$

$$\therefore d = \left( \frac{1+i}{1+r} \right) - 1 = 1.87\%$$

$$\therefore a_{nr} = 19.83$$

$$\therefore P = (m + uL) \cdot \lambda W_o \cdot a_{nr} \\ = (270.00 + \frac{2.06 \cdot 1 \cdot 1800}{100}) \cdot 75 \cdot 19.83 \cdot \lambda \\ = 132 500 \cdot \lambda \quad (\text{Rand})$$

The higher priced, higher efficiency motor has the lowest overall cost and is accordingly the economic choice.

There is also an alternative way to express the capitalised cost of the losses. We have had

$$\lambda = \frac{1}{\eta} - 1$$

$$\therefore \frac{d\lambda}{d\eta} = -\frac{1}{\eta^2} \quad (\text{by differentiation})$$

$$\therefore d\lambda = -\frac{d\eta}{\eta^2}$$

Neglecting the sign the change in price, namely  $dP$ , is given by

$$dP = \frac{132 500}{\eta} \cdot d\eta$$

$$= 153 200 \cdot d\eta \quad (\text{since } \eta \approx 93\% \text{ in this case})$$

$$\text{if } d\eta = 1\% \quad (0.01)$$

$$\text{then } dP = 1 532 \quad (\text{Rand per 1\% change in efficiency})$$

In the above example the difference in efficiency is 93.5—92.8 = 0.7%. Therefore the change in capitalised cost is 1 532.07 = 1 072. This compares favourably with the difference calculated above, namely 10 280—9 211 = 1 069, the difference being due to rounding off.

This method of expressing the cost of capitalised losses in rand per 1% change in efficiency is a most useful one and permits a ready evaluation of relative efficiencies. In the case of larger motors it can be included in tender enquiries to enable manufacturers to make their most economic offer.

#### 5.5 Cables

The selection of the most economic cable size for a given load and duty is a typical application of one of the two cases dealt with in general terms in the section on mutually exclusive projects (section 4.3.7), namely the case where the expenditure cash flow stream bears an inverse relationship to the capital outlay. In the case of cables the annual load loss cash flows bear an inverse relationship to the cost of the cable. The reason for this is that the load losses are inversely proportional to conductor cross-sectional area while the cost of the cable is directly proportional to the cross-sectional area.

Let C = cost of cable  
 $x$  = cross-sectional area of conductor  
 $b$  = constant applicable to cross-sectional area related portion of cost  
 $h$  = constant applicable to fixed portion of cost  
 $C = bx + h$

Then using similar terminology to that used earlier, we have the following expression for the annual cost of the series load losses.

$$A = (n + uTL) \cdot NI^2 R$$

$$= (n + uTL) \cdot \frac{NI^2}{x}$$

Similarly, the capitalised value (P) is given by the following expression.

$$P = A \cdot \frac{a_{nr}}{r}$$

$$= (n + uTL) \cdot \frac{NI^2}{x} \cdot \frac{a_{nr}}{r}$$

V = cost of cable plus capitalised cost of losses

$$V = C + P$$

$$= (bx + h) + (n + uTL) \cdot \frac{NI^2}{x} \cdot \frac{a_{nr}}{r}$$

As demonstrated in section 4.3.7, the minimum cost point is obtained by differentiating V with respect to the variable x and equating to zero.

$$\frac{dV}{dx} = b - (n + uTL) \cdot \frac{NI^2}{x^2} \cdot \frac{a_{nr}}{r} = 0$$

This equation can be rearranged, as follows.

$$\frac{bx}{a_{nr}} = (n + uTL) \cdot \frac{NI^2}{x}$$

In this form the equation is an expression of Kelvin's law, namely that the most economic cross-sectional area is that which equates the annual capital charges on the variable portion of the cable cost (namely  $bx/a_{nr}$ ) to the annual cost of the load losses (namely

$$(n + uTL) \cdot \frac{NI^2}{x} \cdot \frac{a_{nr}}{r} \cdot 3^m$$

This equation can be further rearranged as follows to give the most economic cross-sectional area.

$$x = \sqrt{\left[ \frac{(n + uTL) \cdot NI^2 \cdot a_{nr}}{b} \right] \cdot 3^m}$$

The above analysis is based on an assumed constant cost of electricity and a uniform peak current for the full economic life of the cable. This, however, is rarely the case in practice. As we saw earlier (section 5.3) account can be taken of both load growth and inflation by applying a multiplying factor B to the non-inflationary case, as follows.

$$P = A \cdot \beta \cdot \frac{a_{nr}}{r}$$

Should there be no growth but only inflation the value of B is given by the following relationship (section 5.3).

$$\beta = \frac{1}{(1+i)} \cdot \frac{a_{nr}}{a_{nr}}$$

$$\text{where } d = \left( \frac{1+i}{1+i} \right) - 1$$

The formula for the most economic cross-sectional area can then be rewritten as follows.

$$x = \sqrt{\left[ \frac{(n + uTL) NI^2 \beta a_{nr}}{b} \right] \cdot 3^m}$$

Example (37): Determine the most economic cross-sectional area for an 11 kV three-core screened paper

insulated cable with (a) copper conductors (b) aluminium conductors, to carry a steady and constant peak current of 10 amps with no load growth, given the following data.

$m = 70,00$  Rand/kWh per annum  
 $u = 1,06$  cents/kWh  
 $T = 8760$  hours  
 $L = 0,20$   
 $r = 9\%$  per annum  
 $i = 8\%$  per annum  
 $n = 30$  years  
 $N = 3$  (three-core cable)  
 $\beta = 0,01793 \mu\Omega \cdot m$  (copper)  
 $= 0,02940 \mu\Omega \cdot m$  (aluminium)  
 $b = 183\ 000$  (copper)  
 $= 132\ 000$  (aluminium)  
 $h = 7,5$  (both copper and aluminium)

Determine first the various financial factors.

$$d = \frac{1,09}{1,08} - 1 = 0,009259$$

$$a_{nr} = 26,089$$

$$a_{nr} = 10,274$$

$$\beta = \frac{1}{(1+i)} \cdot \frac{a_{nr}}{a_{nr}}$$

$$= \frac{1}{1,08} \cdot \frac{26,089}{10,274} = 2,35$$

The various values can now be substituted in the equation for the most economic cross-sectional area. The calculation in the case of copper is as follows.

$$x = \sqrt{\left[ \frac{(70,00 + 1,06 \cdot 8760 \cdot 0,20) \cdot 3 \cdot 0,01793 \cdot 10^{-6} \cdot 2,35 \cdot 10,274}{183\ 000 \cdot 1\ 000} \right] \cdot 150 \cdot 10^6 \text{ m}^2}$$

$$= 119 \text{ mm}^2$$

The nearest standard size is 120 mm<sup>2</sup> (copper). The corresponding section for the aluminium alternative is 179 mm<sup>2</sup>, the nearest standard size being 185 mm<sup>2</sup> (aluminium). The maximum rating of these two sizes of cable is around 270 amps, hence the peak load to be carried is well within the respective ratings. Alternatively, it is clear that the most economic size of cable is around three to four standard sizes larger than would be required on the grounds of current rating alone.

The above example considered a steady load over the life of the cable. In practice a cable will start life at a relatively low load with the load increasing progressively to a certain level, either the full load or firm rating of the circuit, and then remaining at this level for the rest of its economic life. In such a case the value of B will be higher and in practice could range between 5 and 10.

To gauge the effect of different values of B on the economic cross-sectional area, consider a mean value of 7,5 for B. Substitution of this value in the above equation gives the following values.

copper : 213 mm<sup>2</sup> (nearest standard size, 240 mm<sup>2</sup>)  
 aluminium : 320 mm<sup>2</sup> (nearest standard size, 300 mm<sup>2</sup>)

It should be noted that these sizes are for an initial peak current of 150 amps. For the assumed value of B = 7,5 this could well imply a final peak current of around 360 amps.

To conclude this section on the economic selection of cables an alternative method of selecting the most economic size will be demonstrated. This process entails scheduling the relevant standard sizes, as follows.

Example (38): Assume the same data as before but with an intermediate and lower value of B = 5,00. The relevant data, based on a one metre length of cable and an initial peak current of 150 amps, is given in Appendix B.

From an inspection of the figures in this appendix it is clear that the most economic size is that given by the

lowest overall capitalised cost, namely 185 mm<sup>2</sup> (copper) and 240 mm<sup>2</sup> (aluminium).

It is of interest to plot the above results as this clearly indicates the factors involved, particularly how escalating cable costs are progressively and more rapidly offset by the decreasing capitalised cost of the losses. The relevant curves are given in Appendix C. The flatness of the total capitalised cost curves in the region of the optimum sizes should be noted. This indicates the relative insensitivity in this area to the selection of the most economic size.

The various results of the above analysis are summarised below and, for completeness sake, the relevant sizes for  $B = 1,00$  are also included. The figures quoted are the cable sizes expressed in mm<sup>2</sup>.

conductor	rating size	$\beta = 1,00$	$\beta = 2,25$	$\beta = 5,00$	$\beta = 7,50$
copper	50	70	120	155	240
aluminium	70	120	185	240	300

The above brief analysis clearly indicates how important it is to give due consideration to load growth patterns and inflation rates in economic studies. In general, it may be said that the most economic size of cable in today's highly inflationary environment is definitely several sizes

larger than that which would be dictated purely on loading considerations alone.

Little attention appears to have been paid in recent years to the economic selection of cable sizes, particularly taking into consideration load growth and inflation. It is considered that this is an area that should be given closer attention in the future and one which could well form the subject of a separate paper.

## 6. CONCLUSION

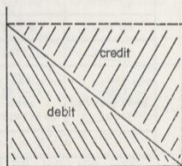
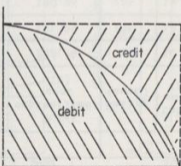
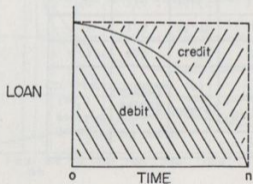
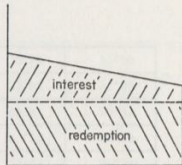
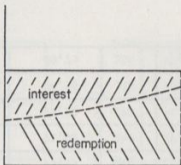
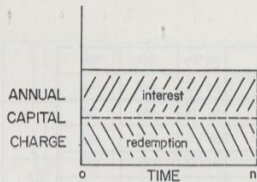
In this paper an attempt has been made to outline the basic mathematical principles of economic analysis and their application to practical problems. The main objective was not to cover all aspects of engineering economics but rather to concentrate more on the underlying principles, a thorough understanding of which is so essential to a full appreciation of the various techniques and strategies involved in investment appraisal. If this paper has stimulated an interest in economic matters then it will have served its purpose. As a guide to further reading a list of selected references is appended (Appendix D).

## 7. ACKNOWLEDGMENTS

In conclusion, I would thank the City Council of Cape Town for enabling me to present this paper. I would also extend my thanks and appreciation to those members of my staff who so kindly assisted in its preparation.

## REFERENCES

- Merrett, A. J. and Sykes, A.: "The finance and analysis of capital projects" (Longmans, 1963).
- Merrett, A. J. and Sykes, A.: "Capital budgeting and company finance" (Longmans, 1966).
- Langhout, J. and van der Meyden: "Introduction to the mathematics of finance" (Balkema, 1965).
- Grant, E. L. and Ireson, W. G.: "Principles of engineering economy" (Oxford Press, 1970).
- Bolton, D. J.: "Electrical engineering economics" (Chapman and Hall, 1950).
- Bierman, H. Smidt, S.: "The capital budgeting decision" (Collier MacMillan, 1972).
- Broster, E. J.: "Appraising capital works" (Longmans, 1968).
- National Economic Development Office: "Investment appraisal" (H. M. Stationery Office, 1971).
- Alfred, A. M. and Evans, J. B.: "Discounted cash flow" (Chapman and Hall, 1971).
- Norris, T. E.: "Economic comparisons in planning for electricity supply", Proc. I.E.E., 1970, 117, (3), pp. 593 and Coorrigenda, Power Record (reprinted from Proc. I.E.E., 1971, 18, pp. (ii)).
- Rudd, D.: "A general theory of depreciation of engineering plant", Proc. I.E.E., 1961, 108(A), 41, pp. 341.
- Bolton, D. J.: "The economic rating of motors and transformers", Journ. I.E.E., 1944, 91, Pt II, pp. 195.
- Szwander, W.: "The valuation and capitalization of transformer losses", *ibid*, 1945, 92, Pt II, pp. 125.
- Mondal, J. A.: "Evaluation and capitalisation of transformer losses", R & L Engineers Diary, 1959.
- Stewart, P. G.: "Evaluation of transformer losses", The Electrical Engineer, February 1980, pp. 18.
- Klein, K. W.: "Economics of distribution transformer losses and loss ratios", The Line, January-February, 1961.
- Smit, A. S.: "Evaluation of motor efficiency", The Electrical Engineer, June 1980, pp. 53.
- Abramowitz, D. E.: "The effect of inflation on the choice between hydro and thermal power", Water Power and Dam Construction, February 1977, pp. 34.
- Olivier, Dr. H.: "The engineer fights inflation", Municipal Engineer, July/August 1977, pp. 47.
- Shuttleworth, A. B.: "A view of inflation in South Africa today", The Professional Engineer, Vol. 7, No. 2, April 1978, pp. 33.



LOAN (SINKING FUND)

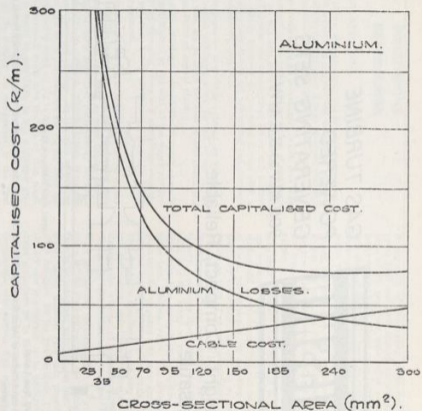
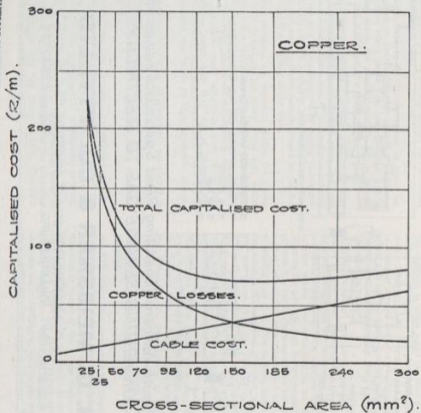
ANNUITY

STRAIGHT LINE

## LOAN REDEMPTION METHODS

CAPITALISED COST OF CABLE LOAD LOSSES

Cross-section (mm <sup>2</sup> )	Copper				Aluminium			
	Rating (amps)	Cable cost (R)	Capitalised cost losses (R)	Total capitalised cost (R)	Rating (amps)	Cable cost (R)	Capitalised cost losses (R)	Total capitalised cost (R)
25	110	12,08	220,26	232,34	90	10,80	361,16	371,96
35	135	13,91	157,33	171,24	105	12,12	257,97	270,09
50	160	16,65	110,13	126,78	125	14,10	180,58	194,68
70	200	20,31	78,66	98,97	155	16,74	128,99	145,73
95	240	24,89	57,96	82,85	185	20,04	95,04	115,08
120	270	29,46	45,89	75,35	210	23,34	75,24	98,58
150	305	34,95	36,71	71,66	240	27,30	60,19	87,49
185	340	41,36	29,76	71,12	270	31,92	48,81	80,73
240	390	51,42	22,94	74,36	310	39,18	37,62	76,80
300	435	62,40	18,35	80,75	350	47,10	30,10	77,20

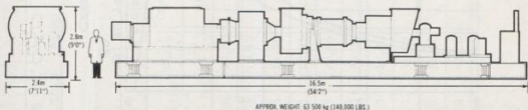


CAPITALISED COST OF CABLE LOAD LOSSES.



## GAS TURBINE POWERED GENERATING SETS 900 KW to 8,6 MW

Lightweight, Compact, Reliable  
and Versatile

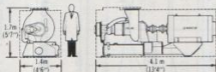
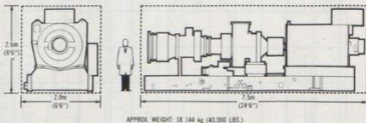


### MARS 8,6 MW Sea Level

Let any one or a combination of these Solar Gas Turbine Generating Sets take care of your Emergency Power and Peak Lopping requirements.

### CENTAUR 3MW Sea Level

The Solar range of INDUSTRIAL Gas Turbines incorporated in these packages ensures a long and trouble free life with minimum maintenance.



### SATURN 900 kW Sea Level

The Meissner Group can help Municipalities  
Save Money  
Save Fuel  
Save Electricity Costs

Let the South African Generating Plant Specialists advise you on  
**CONVERTING SEWAGE GAS TO ELECTRICITY**

## H. G. MEISSNER & CO. (PTY) LTD

29/31 MEWETT STREET, OPHIRTON,  
P.O. BOX 10867, JOHANNESBURG.

Phones: 838-4714/5



## DISCUSSIONS BESPREKINGS

### MR. R. WIFFEN: AFFILIATE

Casual perusal of this well prepared and detailed paper would suggest that the subject of engineering economics presents some very formidable problems but it is to be hoped that this does not deter readers from closer study of the paper.

There are many publications on accountancy which deal with the subjects discussed in the paper and a number of engineering texts refer to, and use, some of the material to explain the economics of things like transformer losses and turbine heat rates etc. Rarely however do we come across such a useful combination which directs the accounting and economic theory to the engineering problems.

I believe that the paper — or perhaps I should say volume — will become a useful reference work for all of us in the supply industry who are so often involved in the choice and purchase of large items of capital plant.

There are a number of things I would like to speak about in support or in amplification of the text of the paper particularly in the light of changing views and experience over the years and with reference to our experience with major international lending agencies.

Firstly, Mr. Palser has referred to the time value of money and has drawn attention to the fact that one rand today does not have the same value as one rand at some future date. I think this is a particularly important consideration for engineers who often have to compare initially higher costs for plant with future potential savings. At the risk of stating the obvious there can be no justification for paying more for expensive high efficiency plant simply to recoup its additional cost by reduced operating costs over the life of that plant. In such a case it would be preferable to buy a cheaper product and to put the difference in price in the bank where it will learn interest. In making the comparison in the first place this potential interest should be subtracted from each of the anticipated future annual savings or, more appropriately, the anticipated future savings should be discounted by at least that interest rate.

The emphasis here must be on the expression 'at least' because there can be no justification for spending additional money at the outset which could have been invested with a guaranteed return unlike the possibly doubtful future annual savings arising out of the use of a more expensive plant.

In this connection Mr. Palser has laid down some guide lines on the margins which should be allowed to cover risk and uncertainty. These guide lines are of necessity somewhat subjective but they may be summarised by saying that a 2% margin is acceptable and 6% is highly acceptable. It could be argued however that an acceptable margin should be related to the rate of interest prevailing at the time.

My firm has been carrying out economic studies for power utilities using DCF techniques for many years and, whilst opinions differ from one utility or lending agency to another, it would, I think, be fair to say that a 50% increase over the lending rate is generally considered satisfactory. Bearing in mind that interest rates were somewhat lower when Mr. Palser prepared his paper than they are at present, his example of a 9% interest rate and a 14% DCF yield would fall into this category and be, as he says, 'generally acceptable'.

I think before leaving the subject of acceptable margins it is important to stress that we are thinking only in terms of public utility practice as, in the private sector where the risks may not be so readily assessed, the required rates of return can be much higher.

Mr. Palser has dealt at some length with inflation and its treatment in economic studies, because this is one of the most important, and perhaps least understood, factors we have to deal with. He has explained the relationship between interest rates and inflation and in this connection it is of interest to look back at past rates. The first ESCOM loans in 1923 for example were at 42% interest and, at the take-over of the VFP in 1948, the rate had fallen to 31%. The first IBRD loan to ESCOM in 1951 was at 4%.

A summary of generating plant costs in SA between the years 1946 and 1966 showed an average increase in turbine price of 2% per year, with boiler prices rising at a slightly lower rate of 1.6%. These price increases related to the same unit sizes so that there were no cushioning effects caused by economies of scale. During that same period, ESCOM interest rates increased to some 6½% so that the return on money had kept pace with inflation during that period. It was not until the 1970's that inflation began to outstrip the rise in interest rates and we are now in a situation where the true interest rate is negative in terms of real money values.

It is clear therefore that inflation is a very important factor and we must take note of it in some way in our economic studies and comparisons. This can be done in two ways, one of them, paradoxically, by ignoring it in the first instance and later considering the effects of possible differential inflation as part of normal sensitivity studies. With the other method, inflation has to be built into all aspects of the study. Most important, the two methods should not be mixed, which is very commonly done. With the first method all costs are built into the study at current price levels and discounted until such time as both the considered alternatives have the same total lifetime value. The discount rate so calculated must then be compared with some genuine underlying interest rate not exceeding 5%. On this basis a DCF return of 8% to 10% would be considered to be very good. Having completed this calculation, sensitivity studies should be carried out to observe the effects of possible differential inflation and changes in load factors and other possible variables.

With the second method, all costs are inflated at agreed rates before discounting and the resulting discount rate has then to be compared with current high interest rates or even some higher national rate that provides a suitable return after inflation. Of the two methods, I believe the non-inflationary one is generally to be preferred as it avoids or reduces conjecture as to future rates of inflation. In using it however it is very important not to confuse the result by comparison with current high interest rates as is only too often the case.

Inflation is also very important in tender adjudication where the question is often asked — should we take inflation into account in comparing one plant efficiency with another! The simple answer would appear to be 'yes' providing that discounting is carried out at a realistically high rate which, so often, it is not for one reason or another, usually because the funds used to purchase the plant are available at artificially low interest rates.

A good example of this arose recently in connection with the value of the heat consumption of a steam turbine to be purchased out of an 8% European Investment Bank loan for a neighbouring state. The lifetime fuel cost of this plant at current prices was estimated to be R9.8-million and it is clear on the premise that future rands are less valuable than present day rands (because of the interest that can be earned on the latter) the true discounted life time value should be something less than this. In fact, discounting at 5% reduced the value to R7.4-million. However, since the interest rate at 8% was lower than the rate of inflation (assumed to be 10%), the discounted, inflated lifetime value in fact rises to R10.8-million. Perhaps, in the case of soft European or IBRD loans, one should take advantage of this absurdity, but Municipal loans are another matter.

Mr. Gorven, in his paper yesterday, discussed Consolidated Loan Funds at some length and, since it is often the current low interest rate of these funds which is used in capitalisation formulae, the introduction of high inflation into our sums would result in unnecessarily high capital expenditure. In general, we find that it is safest to adopt a relatively low underlying interest rate of, say, 3% to 5% and to ignore inflation.

Mr. Palser has also mentioned the importance of building the correct loading regime into capitalisation calculations. This is most important, as an incorrect assumption can produce an error in excess of the wrong choice of interest rate or the wrong number of years of study. In general, it may be said that capital plant for power supply systems has one or two loading regimes — the first applying to most distribution systems where loading is light in the first year and builds up to a maximum over a period of years. The other, more gene-

rally, applies to generating plant which starts off at high load factor which falls over the following years as other larger, and more efficient, plant takes its place in the order of merit table. The correct or discounted load factor to be used in these cases is perhaps best illustrated by an example of a generator on the one hand starting off in year one at 80% load factor which falls to 5% in the last year of its life. On the other hand we may consider a distribution transformer with exactly the reverse loading regime. The average annual load factor in both cases may be shown to be 28% but the 'discounted' load factors are 24% and 18% for the generator and transformer respectively. Wherever possible, therefore, it is important to endeavour to judge the likely use of the plant over its lifetime as accurately as possible.

A word now about the comparison between alternatives having different lives. Mr. Palser has quoted, perhaps, the best known method which requires a study period equivalent to some common multiple of the lives of the alternatives. I am not keen on this method, which involves setting up a lengthy study programme which becomes largely conjectural in later years. A shorter and completely acceptable method is to credit the longer life alternative with a pro rata capital sum in the last year of the shorter life alternative. This capital sum is then discounted with all the other money values.

The subject of interest during construction has been touched upon and I would like to say something about its application in economic studies. It is customary in studies carried out for, or by, the main lending agencies to discount from the first year of capital expenditure on a project instead of the first year of commercial use. I believe this is a mistake in that it does not recognise IDC as being as much part of the cost of the project as the plant itself. If, for example, we build IDC into the capital cost of the scheme at the true borrowing rate and start discounting as from the date of commercial use we get a true reflection of the rate of return on the project. The other way builds in the cost of IDC at the project rate of return and not at its true cost.

I would also like to say something about what happens after the decision has been made to incur higher capital cost in order to reduce later recurring costs, particularly in the context of the electricity supply industry. It may be assumed that the discounted rate of return with the selected alternative is higher than the interest rate on which the electricity tariff is based, in which case lower annual costs will result (and therefore lower tariffs) providing the electricity accounts are based on depreciation by sinking fund. If, now, it is the practice of the supply authority to make contributions to a capital development fund calculated on some proportion of total capital asset value, the higher capital cost alternative chosen will incur a higher contribution to the fund and it is important to ensure that this does not raise the actual charges to the consumer above those he would have paid had the less economic scheme been chosen. This is something which should be looked at when deciding upon the acceptable rate of return.

I think I should finish as I started by congratulating Mr. Palser on his very interesting paper and repeat my belief that it will become a useful reference work for all of us in the supply industry.

#### MR. L. C. STOFFBERG: ESCOM

Mr. President, I should also like to compliment Mr. Palser for his very thorough presentation of the basic mathematical principles which underlie the economic analysis of engineering alternatives. The very comprehensive paper will be of great value not only to students of engineering economics but especially also to practising engineers.

The scope of the alternatives which confront a public utility may, in some respects, be more restricted than those encountered by the private sector. The possible diversification into unrelated activities, for instance, does not arise as one of the options open to an electricity undertaking. On the other hand, an electricity undertaking must plan to meet the total needs of its consumers while, in the case of a private industry, the response to an increasing market may be tempered by its own economic considerations. As we heard yesterday as part of the President's Address, the work load of an electricity undertaking is something over which it has no control. The demands of new and increasing supplies simply have to be met.

Mr. Palser has, however, shown the many and diverse other alternatives which do confront an electricity undertaking and which require competent economic analysis.

For possible comment by Mr. Palser, I should like to emphasise the view that a valid economic analysis is not affected by, nor is it dependent upon, the particular accounting policies or financing procedures adopted by the undertaking concerned. You will remember that Mr. Gorven touched on this point yesterday when he referred to the danger that the use of an averaged consolidated loan interest rate may distort the economic assessment of a project.

In my view one should distinguish between economic feasibility and financial feasibility. The nature of the provision made for the replacement of assets, or the system adopted for the repayment of loans, should not form part of an economic study of engineering alternatives. The arrangements chosen for the repayment of capital have no effect on the economic viability of an engineering project. The feasibility of a project from a financial point of view is, however, closely related to the questions of the promoter to raise the necessary money to repay the loans and to maintain a reasonable degree of solvency at all times.

The point is that the economic merit of a scheme can be studied in isolation, whereas financial feasibility requires consideration of the financial resources and financial policies of the organisation involved.

In the choice between engineering alternatives, the planning engineer should confine himself to the economic analysis. It is unnecessary and perhaps even undesirable for him to attempt to incorporate the particular accounting policies adopted by his management regarding the depreciation of assets on the repayment of loans or other financial factors.

#### MR. A. HUGO: SANDTON

Mr. President, Ladies and Gentlemen, I would like to add my congratulations to Mr. Palser on a most interesting and useful address. Mr. Palser has, without doubt, put a tremendous amount of effort and very many hours of work into the preparation of what is an excellently prepared paper. I am grateful to him for what I have gained from the study of it. An aspect of the paper which is particularly pertinent to present circumstances is the treatment, in economic terms, of inflation or erosion in the value of money. Inflation has become endemic and efforts by various Governments to contain it have been largely unsuccessful with little prospect of any change in the future.

In the prevailing circumstances, we should then make provision to lessen, if possible, the impact of this malady on our consumers. There is little municipalities can do in regard to increases in the energy content of the consumers' account which is a passing-on of the increase from the bulk supplier — ESCOM.

However, in regard to that portion of the account which contributes to the Council's interest and redemption, the impact can be lessened by the choice of the method by which the loan is repaid.

In Mr. Palser's paper it is pointed out that, in general, municipalities apply the straight-line rather than the annuity method of loan repayment.

In a situation of continuing inflation, the straightline method of loan repayment has one severe drawback. The method provides for relatively heavy repayments in the earlier years with progressive tapering off in the latter years. This is in direct conflict with what the value of money is doing. To provide adequately for inflation we should, in fact, be doing the exact opposite, i.e. the loan repayments in the earlier years should be relatively low with a progressive increase in the latter years. In this way the consumer would contribute, by way of his electricity account, an annual amount which would approach a constant figure in real terms.

This is, perhaps, better illustrated by an example. Consider for instance the installation of a miniature sub-station costing R10 000 to provide an electricity supply to a number of consumers. To the consumers supplied from this minibus, the material benefit is the same whether the energy is supplied in year one, or to the next generation in year twenty five.

Since each of these consumer groups receives an equal benefit from the minibus, is it then fair that the capital charges in real terms should be substantially higher for the year one consumer group? To put this into figures, assuming interest

at 10% and a discount rate of 10% in the purchasing power of money, the consumers in year one contribute R1 400, whereas the consumers in year twenty five contribute R45 at the present day value of money by the straight-line method of loan repayment. These figures improve to R1 100 and R110 respectively if one applies the annuity method of loan repayment.

Guided by the trend shown by the previous figures, one could be quite revolutionary and yet follow sound economic principals. In this I am suggesting a method of loan repayment in which the redemption portion of the loan would be redeemed gradually during the early period with ever increasing repayments as the maturity date approaches. This would be a more equitable system of repayment since, in real terms, the redemption burden would be carried equally by the benefiting consumers over the life of the asset. In the example chosen the repayments in the first and twenty fifth years would be R1 040 and R1 400 which, in real terms, would be equivalent to R1 040 and R140 respectively. This, to a first approximation, would be a ratio of 7:1 compared with a ratio of 31:1 by the straight-line method.

I hope that the use of figures is not confusing to my audience. The point that I am attempting to make is that, whereas by the straight-line method, the consumers in the first year would carry a burden which is 31 times greater than that carried by the consumers in the twenty fifth year, this figure can be reduced to a ratio of 7 to 1 by a simple geometric progression of the redemption payments throughout the loan period.

I have not gone so far as to suggest that the interest, too, could be treated in this way as it may mean having to borrow money to finance the loan repayments in the earlier years. This proposal would probably not meet with the ready approval of our Town Treasurers although, in principle, I consider it sound. Share capital used in the establishment of a new venture is, in effect, a loan on which the interest and redemption repayment is deferred. The whole economy of our country and, in fact, that of the western world, is based on this basic principal for providing working capital.

As mentioned in Mr. Palser's paper, the way in which the loan is redeemed departmentally is merely a book entry in which a charge is made against the department making use of the borrowed funds. The way in which the funds are accumulated to provide for the eventual redemption should therefore not be an issue, provided that a sound plan exists for meeting the loan on the maturity date.

In conclusion, Mr. President, may I thank you for having invited me to contribute to a well written paper of which Mr. Palser can with justification be proud.

#### MNR. G. NORTJE: GERMISTON

Meneer, die President, ek wil graag mnr. Palser gelukwens met hierdie referaat. Om werklik nut daaruit te put verkry redelike intensiewe studie, wat beslis die moeite werd is. Ek sou graag mnr. Palser se kommentaar verneem in verband met die volgende:—

An equation similar to that derived in section 5.5 for cables, could also be derived to calculate the most economic rating of a transformer for any specified load condition. Would Mr. Palser recommend this approach for determining the ratings of distribution transformers, bearing in mind that a transformer so selected is likely to have a rating considerably in excess of the maximum load?

In the example in section 5.5 it is concluded that, for the load conditions specified and a peak load of 150 amps, the most economic size of cable is 120 mm<sup>2</sup> copper, if the escalation in the cost of electricity is 8% per annum.

If one adopts the alternative approach of equating the annual capital charge on the variable portion of the cable cost to the cost of the copper loss for the first year of operation, it is found that the most economic current for a cable of 120 mm<sup>2</sup> is 245 amps. If this calculation is repeated for increasing electricity costs, it will be found that the most economic operating current decreases in inverse proportion to the square root of the cost of the losses. Using this approach, it would therefore be concluded that the most economic operating current for a cable would continually decrease throughout its life, if the cost of electricity rises. However, the escalation in the cost of cable is at least comparable with

the escalation in the cost of electricity. Therefore, in the case of new cable it would be found that the most economic operating current remains at 245 amps, or may even increase depending upon the relative escalations in electricity and cable costs. The aforementioned conclusion therefore appears to be ridiculous. It means that it is more economic to operate a new cable at a higher load than the old cable of the same size, simply because the latter was purchased at a lower cost. I would therefore suggest that the most economic operating current can only be realistically determined if account is taken of the escalation in the cost of cable as well as of electricity.

It is therefore suggested that, in the formula derived in 5.5, an adjusting factor should be applied to the capital cost of the cable, to take into account the future escalation in the cost of cable, as the most economic operating current with the formula in its present form is apparently unrealistically low. Mr. Palser's comments on this aspect would be appreciated.

#### MR. TREVOR GAUNT: AFFILIATE

Mr. President, financial analyses of the kind described by Mr. Palser are based on estimates of future occurrences. The validity of an analysis can be no better than the basis of the estimates. It is most important, therefore, that in building up the cash flows and analysing them, all aspects are correctly treated. These aspects include timing, increased or decreased activity or plant usage and, especially, inflation. Having compiled the cash flow projection, financial analysis may be carried out. Several factors affect the mechanics of analysis, for example project size, project duration and mutual exclusivity. There are techniques for taking these into account. I would like to comment on another aspect, the choice of the discount, interest and inflation rates.

For long term economic stability: inflation rate < interest or discount rate. The assessment of long term investments depends significantly on both the relationship and the changes of relationship between these rates — as influenced by business cycles. How reliable is analysis which does not specifically take interrelationships into account? Admittedly analytical complexity increases if we don't make simplifying assumptions, but this should not deter us if we desire a meaningful answer.

I would ask Mr. Palser, then, whether it is useful to distinguish between "real terms" and "money terms"? These terms anticipate certain assumptions which should modify the techniques used for analysis. Surely the outcome is the same as long as the analysis correctly treats all assumptions affecting the relative desirability of alternative courses of action?

In choosing the monetary relationships to use in financial analysis of engineering problems, as well as in doing the mechanical analysis, engineers may obtain valuable assistance from their treasurers (to whom any economic analysis usually has to be acceptable!). I would therefore like to thank both Mr. Palser and Mr. Gorven for their most useful papers addressing two sides of a subject which is very important to all engineers interested in capital investment.

#### MNR. A. J. VAN DEN BERG: KRUGERSDORP

Oma in die kort tydjie tot my beskikking konstruktiewe kommentaar te lewer op mnr. Palser se referaat is 'n onmoontlike taak want dit is 'n lang storie.

Die referaat dek 'n baie breë spektrum basiese inligting oor ingenieurskonomie en behoort 'n baie waardevolle verwysingsdokument vir sowel die beginner as ouer garde wie al 'n bietjie verroes geraak het te wees.

Die wiskundige begrippe is relatief eenvoudige, soos teen oorgemerik in die referaat, maar die volume daarvan kan — bv. in dié geval van eerste kennismaking in die uiters beperkte tyd wat vir die voordrag van die referaat toegelaat word — verwarrend voorkom.

Item 4 "Economic Evaluation of Investments" dek myns insiens die mees populêre toepassing van koste-ontleding onder hedendaagse omstandighede.

Die noodsaaklikheid dat meer aandag aan hierdie aspek verleen word, word openlik gepropageer deur die sg. Browne Komitee wat ondersoek ingestel het na die finansies van Plaaslike Besture.

Nie alleen word kostevoordeelontleding van munisipale projekte met behulp van die verdiskonteringemetodes voorgelê as 'n evalueringstechniek wat beter finansiële kontrole bewerkstellig nie, die toepassing daarvan op 'n groter skaal as wat tans die geval is, is een van die aanbevelings van die komitee. 'n Verdere aanbeveling in hierdie verband is dat amptenare soos Stadsklerke, Tesouriers, Stadsekretarisse ens. opgelei moet word om hierdie tegnieke deeglik onder die knie te kry. Ek dink mnr. Palsler verdien 'n plumpie vir die eenvoudige maar baie interessante wyse waarop hy sy referaat opgestel het.

#### MR. D. C. PALSLER: CAPE TOWN

Mr. President, I thought I was having an easy time, until Mr. Nortje came along. He has introduced something quite interesting. I will start with his contribution first. Clearly, in the paper one couldn't go into all the various issues. I agree with him that, in the cable calculation, the escalation in the cost of the cable is not taken into account. It was purely a simplistic calculation to bring out the principles involved and to illustrate Kelvin's law. But clearly it can be extended to take into account growth. I personally have not looked at this one yet but, in view of what Mr. Nortje has said, I will now do so.

Going now to Mr. Wiffen's contribution, he spoke about interest rates. He seems to prefer looking at the non-inflationary case and then undertaking sensitivity studies. I have doubts about this. I think it can be done either way. The advantage of the non-inflationary case, though, is that if you look at the real interest rate then, with time, this is likely to remain reasonably steady at around 3% in real terms with respect to loan capital and 6% to 7% with respect to equity capital. So, if you start with these figures, you are fairly safe all the way through. Then you can add on what you deem

to be a suitable figure for inflation. Mr. Stoffberg mentioned the accountancy procedures and I agree with him that they should not be taken into account in economic studies. They have nothing at all to do with economic studies.

It is purely an accountancy procedure, but the rate at which the City Treasurer recharges the electricity undertaking, or a particularly project, influences only the break-even point. It does not effect the ultimate economics of the scheme. You get the same answer either way but the break-even point will change. If you have heavy repayments in the earlier years, you find you break-even further out in time. So the sinking fund method or the annuity method of loan redemption will only influence the break-even point but not the ultimate outcome.

Regarding Mr. Hugo's comments, I agree with him about inflation, but this will only influence the burden on consumers. It is true that doing what he suggested will ease the burden on the consumers. It will spread it out more evenly over a period of time, but I think he knows what it is like to talk to City Treasurers. They have a mind of their own! We, in Cape Town, used to work on the annuity method but recently changed to the straight-line method. I think however, that we would have a job persuading our Treasurers to adopt Mr. Hugo's proposal. I would like to thank the speakers for their contributions. Thank you, Mr. President.

#### MR. D. H. FRASER: PRESIDENT

Mr. Palsler I would like to express the thanks of the delegates to you for the effort you have put into the preparation of your paper. In the written form it is a book rather than a paper and, as Mr. Wiffen has said, it will form a valuable reference work for the members of the AMEU. In appreciation I ask you to accept a tie with the thanks of the AMEU.

## THE TRAINING OF ASIANS FOR THE ENGINEERING INDUSTRIES

By DR. ALEC SOLOMON

Pr.Eng., D.Ed., B.Sc., F.S.A.I.E.E.

RECTOR, M. L. SULTAN TECHNIKON, DURBAN

#### MR. D. H. FRASER: PRESIDENT

We come now to the last of the formal papers to be presented at this Convention and you will notice that this, like the other three papers, is on a subject of general rather than specialised technical interest in deference to the non-technical delegates present.

The subject is nevertheless of vital importance to Municipalities and all other employers of skilled technical manpower at this time of critical shortage of trained personnel. Non-whites are relative newcomers into the professional, semi-professional and skilled technical ranks in engineering in SA and tribute must be paid to the interest and enthusiasm of the many dedicated men and women who are engaged in their education and training. Dr. Alec Solomon who, up to the beginning of last month was Rector of the M.L. Sultan Technikon in Durban, has been among the leaders in this field and we are privileged to have a man of his ability and experience to speak to us today.

Dr. Solomon's academic ladder is a long and impressive one. After obtaining his National Diploma in Electrical and Me-

chanical Engineering and both his Trade and Technical Teacher's Diplomas, he obtained his B.Sc. at the University of SA. But, having been bitten by the teaching bug, he then obtained his Bachelor of Education and Master of Education degree from the University of the Witwatersrand. Not being satisfied with these degrees, he then obtained his Doctorate in Education from the University of South Africa.

Dr. Solomon has been awarded numerous bursaries for research in technical education overseas, and the knowledge gained during his research has been invaluable to Technical Education in South Africa.

Since arriving in Durban in May 1970, he has served on numerous Councils and Committees involved in education, commerce and industry, including service on the Councils of the University of Durban Westville and the Mongasatu Technikon for Blacks at Umlazi.

Dr. Solomon is a Registered Professional Engineer and a Fellow of the SA Institute of Electrical Engineers. He is, in addition, a Member of the SA Institute of Electronic and Radio Engineers. Gentlemen, I give you Dr. Alec Solomon.

## INTRODUCTION:

The rapid advance of scientific discovery and its application to technology has gone far beyond anything that could have been anticipated fifty years ago and man is showing himself to be capable of greater achievement year by year.

The dangers of maintaining a static pattern and system of education have been realised. All countries have had to do a great deal of self-examination and re-thinking about the weaknesses of concentrating all tertiary education on the classical and academic traditions. The changes in educational philosophy which technological development has compelled have been so rapid and of such magnitude that they have been beyond the grasp of many individuals including educationists and teachers.

There are school authorities who still tend to make pupils feel inadequate if they choose careers outside the traditionally accepted professions based on an education in the arts. It is, in some cases, considered undignified to enter an apprenticeship after matriculation and the Technikon is still considered a poor substitute for the university.

The need for educated manpower is a problem common to all countries. It is being realised that the forms of education existing pre-war were inadequate for developing needs and that the industrial reforms taking place can only proceed with changes in the educational system. This was evident as early as 1887 when Huxley, in an address on behalf of the National Association for the Promotion of Technical Education, in England said:—

"The object we have in view is the development of the industrial productivity of the country to the uttermost limits consistent with social welfare."

Technical education by its very nature has to be practically orientated; since it requires the use of tools, machines and materials, its approach is therefore realistic. For this reason it tends to be regarded by those unfamiliar with science and technology as undesirable, non-educational, lacking in culture development, illiberal, devoid of intellectual value, materialistic and neglectful of spiritual values.

In many countries throughout the world liberal studies or general education in one form or another is part of technical education at all levels and not only is a good deal of time devoted to this part of the curriculum but it is also well organised. The aims are the same, namely: to help the student to understand his social environment, to be an adequate member of his community and to learn that no class structure whether dependent on birth, wealth, heritage, type of education, profession or occupational level can be allowed to dominate society. This is accepted as a fundamental necessity at all levels of technical education because of the interdependence of each member of the industrial community on every other member and therefore the interdependence of all members of the community.

The growth of science, invention, industrial organisation and specialisation has created a need for extended education and a demand for equality of opportunity in education.

It has been evident that in every highly industrialised country rapid expansion of industries has created serious problems in the recruitment and training of all categories of qualified personnel i.e. craftsmen, technicians, engineers and other relevant personnel.

The problems I have referred to are also pertinent to the Republic of South Africa and substantial evidence of this is the launching of the Manpower 2000 project. In addition our country faces certain unique problems and demands not only because the nation's industry has to move with the automating times, but also because it must move so much faster than other countries that it can afford to simultaneously carry the double expense of technologically advanced industry and enforced employment of untrained and inefficient labour.

There exists in the Republic facilities for education and training for all ethnic groups and these facilities will assist in providing an additional source of recruitment for commerce and industry.

As many of the delegates present may possess only a little knowledge, or perhaps none at all, of the Asians in South Africa I thought that before dealing with the education and



*Dr. Alec Solomon addressing the delegates.*

training of Asians at the respective levels for the Engineering industries it would therefore be beneficial to sketch their origin and their historical and general background.

## HISTORICAL AND SOCIOLOGICAL BACKGROUND OF THE ASIAN COMMUNITY

The introduction of Indians into South Africa was due to various circumstances; among them the British annexation of Natal in 1843, opening the territory to settlement by British immigrants, and the reluctance of the Africans to engage in continuous labour on the developing sugar plantations, on which the British settlers' hopes for the new colony initially depended.

The European settlers were too few to meet the requirements of the colony's development and in any case were unsuited to do much of the necessary work. To meet the demand for labour, the planters looked to India, with the result that the Natal Legislative Assembly negotiated with the British Government and the Government of India and legislated for the introduction of Indian labour into the Colony and the first immigrants arrived in Durban during November, 1860. The enabling Act provided that Indian labourers be recruited and indentured to employers and the cost of bringing the workers from India was shared by the sugar planters and the Natal Government. Under the agreement between the Governments of India and Natal, the immigrants were to work for five years on the sugar estates. It was agreed that at the end of this period they could either enter into a further contract or become 'free' Indians, and that after a further five years of 'industrial residence' in Natal they were entitled to apply for a free plot of land in lieu of the cost of repatriation.

Indian immigration to South Africa was a selective process. The indentured system served as an alternative to slavery. After the contract expired the labourers became automatically free.

To better understand the complexities of some features of the Indian community which distinguish it from White society it is important, for example, to appreciate that, although they are referred to as the Indian community, a term that implies a measure of homogeneity, Indians are a much divided people, by race, religion, custom and tradition. Convenience in nomenclature and the need for uniformity have conferred on them a homogeneity they do not possess. A popular misconception is to look on them as one people, when in fact they are many peoples, as divergent in language, origin and tradition, as the peoples that constitute the continent of Europe. Muslim and Hindu are the simpler classifications that describe them. Each of these however, is subdivided; Muslims by territorial origins; Hindus into Telugu, Tamil, Hindi and Gujerati speaking groups. Though the caste system and the village order from which Indians spring are breaking down, they still have a great influence on Indian domestic affairs.

It was significant for Natal that, although the Indian population comprised only three per cent of the Union's population at the time, it constituted over 12 per cent of the Natal population and 34 per cent of the total Durban population. It is estimated that Natal's Indian population at present is approximately three-quarters of a million compared with a White population of about half a million. As anticipated, such an increase in the Indian community gave rise to many problems e.g. those of employment, trade, schooling and housing — to mention but a few.

For the first 70 years of their over 120 year history in this country, they remained essentially oriental, ridden by caste, religion, and custom, their education being confined to religious schools and the vernaculars, except where in Christian Mission Schools a few fortunate ones were able to enjoy the elementary education of a western order.

Even at the turn of the century, the number of Indians enjoying some form of education other than religious education, was extremely small and seldom went further than standard II, the attainment of standard IV was a major achievement and conferred upon the Indian boy and his family an element of social status.

It was only in the last two decades or so that serious attention has been given to education at the secondary school level. University education is an even more recent discovery which at one time was the privilege and desire of the few, rather than the right and the ambition of the many. In any case, it needs to be mentioned that in Natal there was no University College even for Whites until after Union in 1910.

With the rise of an Indian middle class there emerged abilities which in the familiar western pattern, impress a society with stability and solidarity. This Indian middle class is almost identical in growth and character to that found in western communities, and indeed is the result of the same forces. Tradition and custom remain, it is true but they are fighting a losing battle. Indians are moving towards the homogeneity of western society.

Particularly noticeable in this "silent revolution", slowly remoulding the thinking of the whole community is the change that has come over the traditional conservatism that characterised the attitude towards Indian women in respect of education and employment. Instead of confinement to homes and early marriage, girls are encouraged to proceed with their studies as far as possible.

## EDUCATION

Soon after Natal received responsible Government in 1893 it not only took away the franchise from Indians but applied segregation in schools.

There were three types of schools — State schools, State Aided schools and private schools.

From 1894 the education of Indians was in the hands of the Natal Education Department and the Indian Immigration School Board established in 1879 was abolished. Traditional education made an impact on the early Indian Community.

It was tied to religion and knowledge of the sacred books and thus confined to religious didactics so that the westernisation process through western education was delayed during the first decades of Indian presence in Natal. After the Cape Town agreement of 1927 which stressed "upliftment" and "western standards", i.e. that Indian South Africans would be more acceptable to the country if they westernised, a number of changes in approach to the traditional culture could be discerned. This became an article of faith for Indians. Citizenship rights were their major concern.

English became the medium of instruction. Gradually communication broke down between the younger and the older generations. Syllabuses were more or less the same as those for Whites and Western education deeply affected the process of breaking up of the Indian's society.

Education for Indian children is today compulsory and is controlled by the Education Division of the Department of Indian Affairs. At present there are 217 598 students/pupils attending  $\pm$  400 schools in South Africa with the majority being in Natal.

Higher education had already received attention. In 1936 part-time classes for those who wished to study in the Faculty of Arts at the University of Natal were arranged; Indians were, however, limited in the faculties to certain subjects. The University of Durban/Westville was established in 1961.

With reference to technical and vocational education, although part-time commercial and technical classes were available for Indians in Durban from 1930, it was not until 1946 that the M L Sultan Technical College was established and full-time courses were offered for the first time. The College main building was officially opened in September 1956.

In terms of the Indians Advanced Technical Education Act, No. 12 of 1968 from March 1st 1969, the status of the College was elevated to that of a College for Advanced Technical Education, placing it on the same level as the White Colleges in Cape Town, Durban, Johannesburg, Port Elizabeth, Pretoria and the Vaal Triangle. The Technikon is a unique institution in that it is the only institution of its kind for Indians in the Republic of South Africa and furthermore it is unique in that it has three educational institutions on one campus. These are a high School, a Technical College and a Technikon.

## EDUCATION AND TRAINING FOR THE ENGINEERING INDUSTRIES

The institutions which provide the necessary facilities for the education and training of Indian personnel at the respective levels as required by the engineering industries, are:

- (a) The M L Sultan Technikon (craft apprentices and technicians)
- (b) The University of Durban/Westville (engineering undergraduates)

### 1. CRAFT APPRENTICES

#### i) The Aims of Apprenticeship

Much has been written and said about apprentices and apprenticeship training and it would be well to view the meaning and aims of apprenticeship.

It has been stated that "The concept of apprenticeship is characterised by the duality of its nature; the apprentice is both learning and earning; the employer is both training him and paying him for productive work. Apprenticeship thus forms part of the system of education and part of the economic system, and the adequacy of apprenticeship turns largely upon its success in harmonising the interests of education and production".

The obligations of master and apprentice of the 'craft gild' days do not differ radically from the obligations of the contracting parties of today. The significant changes would be in the light of the application of the obligations rather than in the text, e.g. in reference to the master's obligations it was stated "that the master was required to provide bed and board and

technical training and whatever is needful for an apprentice; sometimes also a small salary; sometimes even his schooling and a knowledge of languages".

On the part of the apprentice, as his share of the covenant, were demanded obedience, self-control and fidelity to his master's service; he was expected to protect his master from loss, not to steal his master's goods 'not by sixpence in the year' and not to frequent inns or gaming houses.

The obligations of both the employer and the apprentice of today are very similar to those of their counterparts of ancient times, but what is sadly lacking in our modern age is the aspect of social and cultural training of the apprentice which was considered as important as technical and practical training in mediaeval times. Circumstances of today do not permit of the social training of apprentices as in former times, for example, the apprentice's taking up residence with his master from whom he received social instruction. But a revision of the present curricula to include one or two cultural subjects would be of inestimable value to broaden the apprentice's social and cultural background so that he would willingly accept the status and responsibilities of citizenship.

## ii) Training of Apprentices

The Apprentice School is one of seven Divisions of the M L Sultan Technikon and was established in 1975. Previously it was an integral part of the Division of Technology but due to the phenomenal growth in apprentice enrolment it was necessary to establish a separate Division.

The table below illustrates the significant increase in the enrolment at our Technikon of apprentices indentured in the metal, motor and building industries:

TABLE No. 1

Year	Apprentices Enrolled	Total No. of Designed Trades
1969	185	26
1974	765	42
1975	1 003	47
1976	1 007	53
*1977	921	49
*1978	669	47
1979	687	41
1980	911	49

\*Decrease in enrolment due to recession in the Building Industry.

In the Apprentice School, in addition to the run-of-the-mill full-time and part-time theoretical courses for indentured apprentices leading to the National Technical Certificates, the Technikon offers at the request of several large employer organisations practical workshop training to certain groups of apprentices.

The practical training, which we refer to as "Institution Training", is conducted in accordance with the schedules of practical training as prescribed in the Apprenticeship Act by the Department of Labour for the various designated trades.

The engineering trades which have been catered for to date are:—

- i) Radio/Television Mechanics
- ii) Instrument Mechanics
- iii) Fitters, Turners, Welders/Platers (Vecor and Iscor, Newcastle)
- iv) Electricians
- v) Armature winders
- vi) Radio/Telecommunication Assistants for the South African Railways (Special course)
- vii) Telephone Mechanics (G.P.O.)
- viii) Trainees from the SA Indian Naval Battalion (Special practical training)
- ix) Fitters, Electricians and Instrument Mechanics for SASOL II and III. On April 1st, 1980, practical courses for training of adults were in-

duced. The introduction of this scheme has been approved by the Minister of Manpower Utilisation and is part of the Manpower 2000 project which was launched just over a year ago.

## 2. ENGINEERING TECHNICIANS

### i) Introduction

The technician is pre-eminently a product of the advanced industrial society and does not emerge until industry has reached a certain degree of sophistication. Because of the shortage of engineers and their importance a Commission of Enquiry into the Methods of Training for University Degrees in Engineering was appointed in 1957 under the chairmanship of Dr. R. L. Straszacker. The first two parts of the Report were published in 1965 and Part III on Education and Training of the Engineer appeared in 1969.

The Report is the most authoritative statement on engineering education in South Africa and is of great value. Unfortunately most of it was written before the concept of advanced technical education had sufficiently developed in South Africa.

The proposal that all engineers should have a university education and that a common core be provided in each branch of engineering around which variation in content, orientation, emphasis, pace and level could be introduced is however not acceptable today.

One can find the reason for this in the Report itself where it defines the role of the Technician as follows: "An Engineering technician is one who is qualified by specialist technical and practical training to work under the general direction of a professional engineer. Consequently he will require an education which, whilst not so broad or as fundamental as that of the professional engineer, includes an adequate knowledge of mathematics and applied science related to his own speciality. The techniques employed demand acquired experience and knowledge of a particular branch of engineering, combined with the ability to work out the details of a task, and he should be competent to instruct and supervise skilled craftsmen when necessary. The work of technicians, therefore, includes any of the specialized categories of technical work between those of the craftsman and the professional engineer."

In England the Committee on Manpower Resources for Science and Technology used this description in its report on the 1965 Triennial Scientific Manpower Survey: "Technicians and other technical supporting staff occupy a position between that of the qualified scientist, engineer or technologist on the one hand, and the skilled foreman or craftsman or operative on the other. Their education and specialized skills enable them to exercise technical judgement. By this is meant an understanding, by reference to general principles, of the reasons for and the purposes of their work, rather than a reliance solely on established practices or accumulated skills".

The need and the desirability for the training of engineering personnel at both the Universities and the Colleges was postulated in the long awaited Van Wyk de Vries Commission Report which was released during 1975.

Referring to the Republic's manpower needs, the Report says: "At present, South Africa's greatest manpower need is for technicians and other personnel at the intermediate practical level. The factories and commercial and industrial concerns in this country are clamouring for more people who are able to apply their scientific knowledge directly so as to make production, management, administration, marketing, etc., run smoothly. Our universities cannot produce these people; their approach is academic, and it would be wrong to jeopardise their high academic standards by assigning to them a task for which they are not equipped."

There is a crying need in South Africa for practical engineers or high-grade technicians, practical managers and organisers, who ought to be trained at Colleges for Advanced Technical Education."

From various surveys on the functions of engineers it has been established that about one-third concentrate on theoretical functions (research, planning, theoretical problems, teaching, etc.) one-third on practical functions (construction, installation, production and maintenance etc.) and the remaining third on management.

A closer look at the definitions I have just mentioned makes it very obvious that many of these functions can be entrusted to technicians be they engineering technicians or technician engineers.

## ii) Training of Technicians

In the Republic of South Africa the education and training of Technicians is carried out at the Technikon of which there are six for Whites and at the M L Sultan Technikon which is the only one for Indians in our Republic.

The Technikon do not award degrees but conduct courses for the National Diploma for Technicians in Engineering and successful candidates receive a Diploma which is issued by the Department of National Education.

The minimum entrance qualification for admission to the technician courses is a Senior Certificate (Std. X) with Mathematics and a Science subject.

The duration of the Diploma course of approximately 28 subjects is the equivalent of 2 years full-time and is conducted over 4 semesters the equivalent of each being approximately 18 weeks.

The Technikon presently conducts engineering courses for the National Certificates and Diplomas for Technicians. Some of these are:—

- Civil Engineering
- Electrical Engineering (H.C.)
- Electronic Engineering
- Instrumentation
- Mechanical Engineering and Production Engineering

TABLE No. II

### Student Enrolment in the Division of Technology for Engineering Courses (Per Annum)

YEAR	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
NUMBER	57	95	151	223	326	414	358	568	513	425
% GROWTH P A	—	67	59	48	46	27	-14	59	-10	-17

Courses are offered in the Division of Technology on a full-time, part-time and sandwich basis.

#### Certificates

- National Certificate in Architectural Draughtmanship
- National Certificate in Building Technology
- National Certificate for Technicians in Measurement Surveying
- National Certificate for Technicians in Mechanical Engineering
- National Certificate in Mechanical and Electrical Draughtmanship
- National Certificate in Mechanical and Structural Draughtmanship
- National Certificate for Technicians in Production Engineering
- National Diploma for Technicians in Civil Engineering
- National Diploma for Technicians in Electrical Engineering (light current)
- National Diploma for Technicians in Power Engineering
- National Diploma for Technicians: Telecommunications

#### Forecast of growth in student enrolment for the next ten year period

YEAR	1981	1982	1983	1984	1985	1986	1987	1988	1989
NUMBER	606	659	712	766	819	872	924	977	1030

At this stage I would like to draw the attention of the delegates present to a very important factor. In dealing with the "Training of Craft Apprentices" and now with the "Training of Technicians" I have constantly made reference to National Certificates and Diplomas.

This is tremendously important in so far as the ethnic colleges or institutions are concerned. The reason for this is that several years ago a strong move was made to reduce the work load on the examinations section of the Department of National Education.

It was felt that the respective State Departments should conduct their own examinations and be responsible for awarding their own certificates and diplomas. I objected to this very strongly on the grounds that firstly it would have been extremely difficult to evaluate the various qualifications and secondly, and perhaps the most important reason, it would have led to and encouraged discrimination.

In addition to the theoretical tuition, students devote at least a third of their time to practical laboratory work in subjects such as Applied Mechanics, Principles of Electricity, Workshop Technology and so on. After successful completion of their studies the trainee technicians have to undergo two years of practical training at an approved organisation or undertaking after which the National Diploma for Technicians is awarded to them.

## 3. ENGINEERING UNDERGRADUATES

The University of Durban-Westville started its Bachelor of Engineering degree in 1970 with 4 students. The total enrolment in the Department of Engineering in 1979 reached a figure of 150; an annual growth rate of over 30%. As this growth rate is considerably larger than that of the University as a whole it is clear that there is an increasing acceptance by the Indian Community of engineering as a profession.

With an understanding of the many difficulties facing students entering this field of study, the University intro-

duced a number of novel features into the degree course to assist them to reach their goal of a rewarding career in engineering. Perhaps the most controversial change compared with other universities in South Africa was the lengthening of the course to six years.

While the Bachelor of Engineering course has the status of a 4 year Bachelor degree course (and is recognised by both the SA Council for Professional Engineers and the respective engineering Institutes) the academic part of the course has been spread over five years together with a year of practical training in industry. The practical training takes place over two six month periods: the first, in the second half of the third year, is roughly equivalent to the vacation work required by South African Universities; the second period, in the second half of fifth year, is at a more advanced level, of the type required by SACPE for Engineers in Training.

The year of industrial experience serves two very important functions. It enables the student to appreciate the significance of his theoretical and practical training in a real engineering environment and it provides him



with an opportunity to demonstrate his value to prospective employers.

The importance of these points has been accepted by the University and a training officer has been appointed to organise the industrial training and maintain the necessary liaison between employers and the University to ensure that the students are given a sound training.

The motivation for the five year academic training was largely the fact that few engineering students (of the order of 1 in 5) complete the 4 year course in the minimum time. It was felt that it would be more logical to design a course which could be taken more slowly by the normal students. (A four year option is available for the student who has already shown his exceptional academic abilities in his school career). In addition several non-engineering courses have been included in the curriculum. Some examples are English/Afrikaans, Geography, and Oral Communication, Industrial Psychology, Business Economics and Oral Communication.

In 1979, engineering courses were offered in a new Faculty of Engineering, in the branches of Chemical, Civil, Electrical and Mechanical Engineering. Prior to this period these four disciplines had been offered in an integrated department of engineering in the Faculty of Science. The creation of a full Faculty will further enhance the excellent ties which have been built-up between the University and the engineering profession.

#### CONCLUSION:

The expansion in the development of commerce and industry in the Republic as a whole will require large numbers of highly trained personnel and in the knowledge that White labour resources cannot adequately cope with the situation, one does not have to be an optimist to predict a glorious era of change which will see the realisation by the Asian community of their worth and potential. There can be no doubt that at present all groups are enjoying many of the privileges which at one stage were exclusively reserved for Whites only. The number of employment opportunities that have become available to non-

white youth in recent years is not only encouraging but gives one tremendous hope for the future of our country. The significant expansion of some of the older industries and the development of new industries all of which require new facilities, new technologies and supporting services, and at the same time, open up unlimited job opportunities to all the peoples of our Republic. This will demand that there should be closer liaison between commerce and industry on the one hand and the Technikon and the Universities on the other so that a more efficacious system of education and training for all groups can be established to the mutual benefit of all concerned, thereby assisting in reducing our dependence on foreign countries for technical expertise.

In view of the changing character of our country, both technologically and socially, there is a challenge for each and everyone of us and that is that we should take an in-depth look at the colour question, which is and always has been a determinant, and come to terms with it in a far more realistic and dignified manner than we have done in the past.

There is a tendency to conjure up hatred and bitterness whenever reference is made to various 'Race Groups'; could we not recognise these as different cultural groups which give South Africa its unique multi-cultural character. In recognising the dignity of the culturally different group and its individuals we must therefore respect the differences such as historical, sociological, ethnological, religious and language, etc.

I believe that we must not only recognise and respect these various characteristics of the cultural group, but that they should be accommodated and given a position of priority and, by so doing, our Republic may become a mosaic of cultures through which bitterness and hatred are rejected and a catalyst may be provided for uniting our people in a totally new relationship which will be acceptable to all and which, I believe, will achieve the objectives of the Manpower 2000 project, namely: "Increased Productivity and Industrial Growth Through Trained Manpower".

## New in South Africa... 50 years in Europe

### STIEBEL ELTRON HOT WATER SYSTEMS

Reliable economical & efficient - the choice of the experts

Stiebel Eltron is famous for quality, advanced technology and excellent service. The main plant is situated in Holzminden, Germany. Employing over 3500, Stiebel Eltron is one of the leading manufacturers of domestic appliances. High pressure hot water storage heater systems, STIEBEL ELTRON manufactures high pressure hot water systems from 5ℓ to 1000ℓ storage capacity. All appliances are suitable for either central or decentralised installation. Non pressure (push-through)

storage water heaters. Storage capacity from 5ℓ to 80ℓ and suitable for one outlet requirements.

Boiling water heaters. Ideally suited for the home, office or workshop. Also available in 10, 20, 30, 60 ℓ units for hospitals, hotels, canteens etc.

Continuous flow high pressure water heaters. STIEBEL ELTRON offers you a complete range of continuous flow water heaters for home and industry\* (only with the permission of the local Electricity Department), and domestic swimming pools.

Comfort with electricity

### STIEBEL ELTRON

THE HOT WATER SPECIALISTS

Northcliff Plaza  
189 D.F. Malan Drive  
Northcliff 2195  
Johannesburg  
Tel. 46 2041

## DISCUSSIONS BESPREKINGS

### MR. R. M. O. SIMPSON; HONORARY MEMBER

Mr. President, Gentlemen, it is a great privilege and a heavy responsibility to have been asked to open this discussion on Dr. Solomon's address on "The Training of Asians for the Engineering Industries."

In framing my comments, I have done so as an Engineer of some years of experience and, if I have broadened the scope of my comments to include the time element, I hope I will be forgiven, but I have been most interested in education and training in all levels and disciplines of Engineering, as the shortage of skilled manpower is just as damaging as shortage of capital.

I was most impressed with the author's historical introduction of the Indian (or Asiatic) into South Africa. It gives us all a very good foundation on which to appreciate his address and certainly shows Natal's responsibility in this regard.

His comments on the need for the education and training of our diverse population in this rapidly developing country are of great consequence, particularly in respect of the need to provide avenues of employment for our rapidly growing population.

The avenues based on the engineering skills are probably one of the most important. I know in the electrical engineering field this shortage is critical.

This general shortage of skilled staff will seriously affect the country's necessary growth rate unless we can alleviate it.

I have taken some statistics from a Training Symposium "Manpower Training and Development in the 80's" which show the estimated growth figures of training a wide range of employees based on investigations carried out by the "Wiehahn Commission" and set out in Report No. 2. This shows the estimated training requirements in six occupational groups, one of which is that of the skilled employee.

In this group they estimate that in the 8 year period 1979-1987 the training of 570 000 people will be required, or an average of 71 000 per annum, to meet an estimated growth rate of 4.5% (GDP).

To achieve this will require some changes in and extensions of our training facilities and the possible introduction of some emergency schemes.

I recall that, during the last war, the Navy had great difficulty in recruiting sufficient trained mechanical and electrical staff to man the many small craft being built, such as corvettes; mine sweepers etc., and were compelled to introduce crash courses for this purpose. The scheme worked well and the quickly trained staff operated and maintained many of these small ships at sea and in action.

Today we can regard our staff situation as being at emergency levels and should take special steps in an endeavour to alleviate this problem. One suggestion could be to carry out a carefully detailed study of the actual work carried out by each skilled group and transfer some of the less responsible items of work to the semi-skilled group after putting them through special crash courses.

We might also carry this out at all levels from the Professional group down as, in my opinion, professionally trained engineers are carrying out work that could be given to Technician trained Diploma and Higher Diploma technicians. It must be admitted that the present shortage of skilled staff is very damaging to any industry.

The following are training rates for the eight year period for several occupational groups:—

	Over 8 Years	Annual
Professional Employees	1 800 000	225 000
Management Employees	450 000	56 250
Foreman Supervisors	250 000	35 000
Skilled Employees	570 000	71 250
Semi-skilled Employees	1 142 000	142 750

You will note that the skilled and semi-skilled growth requirements are very high.

I would like to have Dr. Solomon's comments on this aspect. In his experience in the training of Asiatics, has he found the present methods suitable? Have the Asiatics an adequate background to enable them to assimilate the engineering knowledge or should some pre-course training be given?

His efforts in the training of Engineering Technicians is particularly noteworthy and, to a large extent, is helping to provide the second avenue of training of engineers quoted in Dr. Strazacher's report on the "University Training of Engineers". He advocated two avenues of training:

(1) The academic and (2) the more practical based on personal ability initiative and leadership ability. This second avenue is to a large extent being provided by our Technicians, such as the Sultan Technikon, in their Technician Diploma Courses.

I understand that at the Durban/Westville University the Engineering Degree Courses have been extended to 5 and 6 years to give time for additional practical work and also to incorporate the humanities in their curriculum.

I would like Dr. Solomon to express his opinion on this aspect. Would it be of help to include the humanities in his Diploma Courses?

The increases in enrolment from 1971 to 1980 of 57 to 425, or an increase of 7.4 times, is most gratifying.

In conclusion, I must apologise for increasing the breadth of my comments, and once again congratulate Dr. Solomon on a most valuable paper; it has given me great pleasure to open this discussion.

### CLR. C. VENTER; JOHANNESBURG

Mr. President, I want to go a little further than just the Indian population, because I believe that there is no one racial group in this country that can make progress or exist without the other racial groups and I believe it is going to be a joint effort in future and not the efforts of one racial group. I would like to expand a little on that and I want to go off at a different tangent. Commenting on the paper, as such, Mr. President, I have certain salient points that I want to bring out. The first is that it is considered undignified to enter into an apprenticeship after matriculation. I do believe that we should all work together to get rid of that idea. I know that that idea exists amongst the youngsters, because it has been planted in their heads that they should go to university.

They can be trained in different directions and that is most essential, as I will prove to you just now. There is a need for educated manpower. That, I think, is very, very important. Much is being said about the launching of the Manpower 2000 project, which is primarily to awaken in us the interest in what is going to happen in the year 2000. Where are we going? According to Professor Gideon Jacobs of the School of Business Leadership of the University of Witwatersrand we will need, in the year 2000, at least 1 million additional engineers and people in top management. We will need to create work opportunities for 8 million additional people. That is what we are being faced with, and that is what we are preparing for.

Mr. President, I do believe the time has come for the Indians in SA to stop being waiters and labourers. They must come into industry and into the professional fields on a much larger scale. They are in commerce as shop keepers, but should enter the field on a much wider basis, because I believe they can make a major contribution in the technical field as well. Then there is a question of training. We have a tendency in this country, as soon as we have a shortage of labour, as at present, to all want to train labour. When we come to a valley period such as two or three years ago, nobody wants to take on apprentices. Has the time not come for more encouragement and a greater effort on the part of the Government and organisations such as the Development and Training Fund of the ECA, the Bifsa Fund and SEIFSA Fund to give much larger monetary grants to employers to train employees during valley periods in the economy, so that when we get to the peak periods we won't suffer from the same shortages as we are suffering from at the moment. I do believe that a very concerted effort will have to be made in this direction. As for the reference to the student enrolment in the division of technology for engineering courses, I find this very disturbing. There is a complete negative growth here. Is it not possibly because the M. L. Sultan is situated in Durban?

Should they not expand? Should they not have branches in Cape Town and Johannesburg? There are 75 000 Indians living in Johannesburg. Should there not be a training opportunity for them as well? Is there no resistance on their part to coming to Durban to take a course here. Should we not have a serious look at this sort of thing?

I would like to hear the comments of Dr. Solomon on the projected population growth of the Indians in Natal. The growth in enrollment should be brought into relationship to the growth of the population in the area. Let us have a look at a few of the aspects that we are going to be faced with in future. We look at the population of the RSA today and, if I may express it in round figures, it is about 26 million people, of which 5 million are white. If we project that to the year 2000, according to figures supplied by the University of Port Elizabeth, the population should be around 51 million, of which 6 million will be white and the rest black. Then you will realise that if we have to create 8 million additional job opportunities in the year 2000, we will have to make greater use of the skill of Indians, Coloureds and Blacks. The blacks have become urbanised. The urbanisation rate according to Professor Oosthuizen of the Rand Afrikaans University is 5.2 per cent per annum and where we have between 8 and 9 million blacks living in the cities of the Republic at the present moment, the figure will be 24 million by the year 2000. They will require work and we have to create opportunities for them.

But, let us have a look at what is happening as far as the births are concerned. According to Dr. Fred Williams in a book he published, entitled "Where have all the children gone", the births of the whites in SA in 1970 were 23.5 per thousand of the population and it dropped in 1979 to 15 per thousand. It dropped by 36 percent during that period. Do you realise that the average white SA family now has 2.12 children per family and 2.11 is the absolute minimum to replace a generation. We are just 0.01 of a child above the absolute minimum that we can drop to.

Do you realise that, as far as the blacks are concerned, the births were 45 per thousand in 1970 and dropped to 38.5 per thousand compared with 15 per thousand for the whites. Do you realise that one of the main reasons for this tremendous drop is the fact that the whites have gone sterilisation mad in this country. Do you realise that between the years 1976 and 1979 three hundred thousand whites, males and females, were sterilised in this country. That is an average of 70 000 per annum. We are actually sterilising ourselves out of existence.

Mr. President, we must stimulate the idea that matriculants can also be artisans. According to Professor Pieter de Lange of the Rand Afrikaans University, we had 50 000 white and 23 000 black matriculants in 1979. In the year 1990 the figure of the Whites will increase to 53 000 and the Blacks to 50 000. In the year 2000 there will still be 53 000 White matriculants and 306 000 Black matriculants. We must cater for these people, we can't leave them hanging around, we must create the job opportunities for them. And it's with this basically in mind that Manpower 2000 was launched. I would like to quote Mr. Basil Herzov, who was President of SA Foundation. He said that if black and white in SA could be brought to the stage where they would, with one voice, express their acceptance of the Republic's internal systems, then there would be little to fear.

I do believe that we will have to get to the point where there will be acceptance. If we create jobs and job opportunities for people then we will go a long way towards acceptance of our internal systems. Life is continually presenting us with great opportunities, brilliantly disguised as insoluble problems and, if we are just prepared to grasp the great opportunities, we are going to build a much greater country and we are going to create better communities than what we had in the past. I would therefore like to add my voice to that of Dr. Solomon in making a very earnest appeal to employers to employ more people of other races as apprentices and as engineers. We must create these opportunities for the people because we cannot afford to have 306 000 black matriculants without any work in the year 2000. This is my earnest appeal to everyone here and I do believe the municipalities can set the example and the rest of industry and commerce will follow them. Thank you.

## MR. ANDREW CHALMERS: NATAL UNIVERSITY

As the President pointed out in introducing Dr. Solomon, the skilled manpower problem is probably the greatest stumbling block facing this country in the modern industrial world.

At the University of Natal, we have over the years had quite a number of Indian students who have graduated in Engineering. This community is now served by the University of Durban-Westville. We are now receiving a steady stream of Black students (and some coloureds) who are finding it even easier to obtain bursaries for University studies; and it is predominantly these students that our slow (5 year) curriculum is designed to assist.

At UND we have reached the conclusion that it is necessary to make allowance for the disadvantaged student — i.e. the student whose schooling was poorer than the norm or the student who has had a less technological upbringing and background than the norm.

I believe that it is probably the lack of technology in one's early formative years that makes the greatest difference between students of different race groups in this country at this time (e.g. handling of engineering materials as a young child).

It may well be that a longer-than-normal curriculum may be a suitable method to follow in allowing these disadvantaged students to find their feet in the engineering academic environment.

## MR. N. P. ADAMS: DURBAN

As stated by Dr. Solomon the White community cannot adequately provide all the artisans, technicians and engineers that are required by industry today. The electricity supply industry is no exception, and has suffered a severe shortage of technical personnel for many years.

Until recently the private sector has been the main employer of technically qualified Asians and in fact there has been little opportunity for these people in the electricity supply industry, but this is changing rapidly, particularly here in Natal. In the Durban Municipal Service for instance, there has been a gradual increase in the opportunities available and in 1980 the City Council opened up nearly all posts to all races, as have many other large undertakings including, I believe, ESCOM.

In 1972 the Durban Corporation Electricity Department indentured its first six Asian apprentices and every year since then a further number has been engaged. At present we have a total of twenty-three Asian apprentices. We find that advertisements for a small number of apprenticeship draw over a thousand applications from Asians, and many of these will have already obtained a technical qualification, some as high as NTC 3 or even T 3. It appears that many school leavers are unable to find suitable employment and so they attend the M. L. Sultan College and acquire a technical qualification in order to improve their chances of finding work of their choice.

The first Asian electricians engaged from outside the service, and who had served their apprenticeships elsewhere, were taken on just over a year ago, and since then only those whose qualifications were unacceptable have been turned away. In the latter category have been one or two trained over a short period in industry in terms of the "In Service Training Act". At the moment we employ over three hundred electricians and of these twenty-nine are Asians. In the past they have been employed in Asian areas only, but in the future they will be required to work in any area in line with Council policy.

In general Asian artisans have proved themselves to be competent and reliable, and staff turnover amongst them is small.

Turning now to other occupations, I might mention that the Department has its own training centre for artisans and apprentices of all races, and has one Asian amongst its staff of instructors. Furthermore four Asian Drafting Assistants were recently engaged for our drawing office.

Regarding engineering technicians, the first three Asian trainees were appointed this year, and it is expected that

more will be taken on soon. The Durban Corporation Electricity Department has one qualified technician at present who is employed as an engineering assistant in the Planning Section.

As far as professional Engineers are concerned, the Department has one Asian employed at Senior Engineer level and will soon have one engineer-in-training. Study loans are available to Asians but at present few have been taken up. It may be of interest to mention that at present ESCOM in Natal have apparently only one Asian technician and no artisans or engineers. A number of Asian apprentices are however, being trained at Roshevville in Transvaal and, when qualified, I understand that they will be posted to the various undertakings.

There is no doubt that the Asian community is going to provide many of the artisans, technicians, and even engineers that will be required by the electricity supply industry in the years ahead in this part of the country at least and the demand for suitable training facilities will certainly increase. I would like to ask Dr. Solomon what the pass rates are at the M. L. Sultan College and the Durban Westville University and how they compare and finally it would be of interest to learn from other delegates of progress being made by non-Whites, particularly Coloureds and Asians, in their respective undertakings.

#### MR. D. KNEALE: ECA

My congratulations and thanks go to Dr. Solomon for a valuable and thought provoking paper on the training of apprentices and technicians in the engineering industry.

With the scrapping of the Electrical Wiring Contractors Act it appears to me that the electrical contractors and the members of the AMEU have the immediate need to approach the Department of National Education to provide a similar or modified technician course for the theoretical training of the electrical installation supervisors and electrical inspectors that we will need in the future to supervise and test the electrical installation work that is going to be carried out. This legislation will be introduced by the Department of Manpower Utilisation shortly and I am sure Mr. Weich is going to tell you more about it later on. As suggested by Mr. Simpson a course including the humanities and sociology would not be out of place in the training of the supervisor and responsible person of the future and, as suggested by the other speakers, a course should be available to all population groups who have the basic educational requirements.

#### MR. A. A. MIDDLECOTE: SABS

Mr. President, I would like to emphasize the common sense attitude given by Mr. Venter. Really, if you look at it, there are two approaches to this problem. The one is our selfish desire — we want someone to work for us, we want them to come and follow either a technician or engineering career. Mr. Venter has pointed out the other national problem where you are going to have three times as many black and non-white Standard 10's as white Standard 10's in a few years time and we have got to find jobs for them. Now, I would like to ask Dr. Solomon if he has had experience in this direction, are we not missing the fundamental approach? It is not our fault, it is a national fault. Many are appreciative of this — I know we have been preaching it for 25 years — and that is, blacks are taught wrong subjects at school. Now if, at the Standard 10 level, the blacks are coming out with no maths, no science and a bare curriculum, you are going to have quite a problem in encouraging them to take up a "dirty" trade, as Dr. Solomon has implied. I think the real problem here goes back to fundamental schooling and, if this is put right, you will have a source of Standard 10's and Standard 8's who could be encouraged, from our selfish point of view, to come and work for us. Thank you.

#### DR. A. SOLOMON:

Mr. President, I don't need a computer to answer the points raised but I think I need a computer to take them down. Mr. Simpson first and his point regarding emergency schemes. One of them is the Adult Artisan training scheme, in which trainees are accepted from the age of 21 upwards. They are given one year of institutional training, the whites go to Westlake in the Cape; we (the Sultan Technikon) had 48

Indian lads last year and from Monday next week we start with a group of 60. The coloureds have a similar scheme in the Cape, but it is not a very big one, so the Adult Artisan training scheme is one of the emergency schemes they are using at present. Mr. Simpson, crash courses can be fitted in depending on the requirements of the particular organisation. We have, over the years, run courses in the vacations. In discussion with a large company at Tongaat they said that they had a large number of Indian lads who had picked up the welding trade from white welders.

Most of the Whites had subsequently left and the Indians who had picked up the trade were doing a very good job of work, but their technical knowledge of welding rods, electrodes and fluxes and the composition of the various metals was not particularly good.

They were nevertheless still doing a good job. I then suggested to the organisation that we have them for 3 weeks; they had a group of 22, so two groups of 11 spread over 3 weeks each were given technical information on welding plus training in our welding workshop, and, of the 22 who ultimately went up for the trade test, about 17 or 18 were successful and are now qualified artisans.

A firm, a big marine, electrical and mechanical engineering organisation at Maydon Wharf, had 11 or 12 armature winders, but they were operators; they were Indian lads and the firm wanted to pay them the full rates of pay, but the members of the trade union working there objected strongly. I had a look at these operators, whose work was absolutely outstanding but, although they were permitted to wind motors, armatures, stators and rotors, they were not allowed to do the final connections. We then had them for 6 weeks at our place, gave them technical information with a certain amount of practical training and, of the 11 who attempted the trade test, 7 were successful. Now these are crash courses that can be introduced. With reference to technician courses, I think Mr. Simpson mentioned that some of these don't do well. What we have introduced at our Institution since 1970, when I first got there, are pre-technician courses for those who passed matric or passed standard ten with a poor pass in maths and science, but were keen on taking up engineering. We then gave them a pre-technician course starting off with a trimester of mathematics, science and drawing. Then when we went on to semesters, we gave them mathematics, science, drawing and chemistry.

Those who did exceptionally well then followed the technicians engineering courses. Another way of overcoming the difficulty is in providing special facilities rather than crash courses and that is to provide day-release classes. We have a group of industrialists in Pietermaritzburg who wanted a metallurgy course conducted for their trainees, but the courses that we were originally running were conducted on a full-time basis or on a part-time basis. As they could not come in from Pietermaritzburg were not prepared to release them on a full-time basis of six months duration which is a semester. We then introduced a day-release course and we had on this day-release course a group of 19 of which 8 were Whites and 11 Indians.

Referring to the diploma courses, Mr. Simpson felt that broad subjects dealing with the humanities should be included. We used to have a subject called General Studies, but that subject has now been changed to Communications. I would also like to see a similar subject introduced for apprentices. I know in the early days some of the technical schools had a subject called Civics and I think one could take a look at the contents of this subject and take certain extracts from it and give it to the apprentices as well. Then Mr. Simpson asked whether Indians have the ability. Indians indeed have the ability and the examination results show that, on the academic side from the NTC 1 to the NTC 3, our apprentices have obtained the highest marks in the Republic! In every block we have at least 5 or 6 highest in the (Technical and Building), Engineering Science and so on. In so far as skills are concerned, the Indian lad has proved himself because, to date, we have trained 160 to 170 apprentices for Venco in Newcastle. They have not a single white or coloured apprentice, so the Indian lad has the ability from the point of manual dexterity to perform his duties.

Mr. Venter, you referred to going a little wider than the Indian group. Mr. President, I agree wholeheartedly and, although my experience has been essentially with Indians, I also serve on two committees concerned with black education, the

one is the Mangosuthu Technikon Council and the other is, I think Mr. Adams brought up this point, concerned with improving education in Black schools, Maths and Science. But looking into the improvement of Maths and Science education in Black schools, there is a lack of good laboratory facilities and so on but a good deal of money is forthcoming from private organisations to assist in the development of this aspect. Mr. Venter referred to entering into an apprenticeship after matric. Not only are the parents at fault, but there are many school teachers who think the Technical Institutions are institutions with a stigma. I think this matter will improve when our career counsellors become more conversant with what is happening in commerce and industry, so that they will be able to enlighten pupils about the job opportunities available to them and show that with an apprenticeship the sky is the limit. This I think depends entirely on career counsellors, even far more than parents.

The apprentices attending full-time block courses come from the employers. We don't take any voluntary students on the full-time block courses. The figures relate only to apprentices who are employed. The voluntary students attend part-time courses only and, where a voluntary student obtains, say an NTC 3 Certificate and is anxious to obtain full-time employment, we refer him to our Student Affairs Department. He merely reports there and the Head of that particular division will do all that is possible to assist the lad to find employment. Then, with reference to the surveys I mentioned earlier, we do not conduct these for the apprentices, because they come from the employers, but our surveys are conducted for all Tertiary courses — not only for the Division of Technology. For example we have a Division of Home Economics, where we have Fashion Design and Textile Design at post standard 10 level. In the Division of Commerce, we have Cost Accounting, Diploma in Commerce, Computer courses and so on and, again, surveys are conducted. In the Department of Catering we have Management courses, Receptionist courses and Cooks courses all at post standard 10 level and, there again, surveys are conducted to see that job opportunities are available. With reference to branches in Cape Town and Johannesburg, I can't speak for Cape Town although I know the population is very small, but in Johannesburg about 5 years ago Mr. O'Gorman, who was the technical adviser to the Department of Indian Affairs, conducted a survey which took in the whole of the Witwatersrand and further afield and the response from the Indians and industrialists was very poor indeed.

I think it was Minister Steyn that stated that the only Technikon for the foreseeable future will be the one in Durban

and not for a long, long time will one be built outside of Durban. But with reference to a Technical College, there is no reason why one cannot be built in due course in either Cape Town or Johannesburg. It depends entirely on the demand and I think that, at the moment, it wouldn't pay to duplicate the Technikon facilities in Johannesburg because of the very small numbers. We have residence for 188 male and 64 female students and not very many come from the Transvaal. In fact they come from all over the country, the Free State being the exception. With reference to the forecast, Mr. Venter was of the opinion that this is a little low in view of the growth of population. I was forecasting in relation to Engineering Technician students only and, as I said earlier, we not only have textile technicians but also fashion and paramedical, which includes health inspectors and public health nurses. We also have the catering groups, receptionists, cooks and so on. That forecast therefore was only for Engineering Technicians. Mr. Chalmers of the Natal University was of the opinion that we should not confine all our efforts to Indian trainees only. I agree that commerce is very interested indeed in other race groups. I agree wholeheartedly that we should do something about other race groups and I am presently involved in just this — one of our priority items.

Mr. Adams, Asians who obtain NTC 3 or a T3 while attending the Technikon as voluntary students should report to the Student Affairs Department if they are unable to find employment. Our pass rate compares favourably with the university pass rate and that of other Institutions. I am referring to courses in Technology and Commerce and so on. Mr. Kneale talks about providing specialist courses. I think that is absolutely necessary, but the organisation should work through the local Technical College or the local Technikon, which will then approach the Department of National Education. Mr. Middlecote referred to students being taught the wrong subjects at school and said that Black students are not taught Maths and Science. I mentioned earlier that I serve on a committee investigating Maths and Science Education in Black schools and this matter is high on the priority list.

#### MR. D. H. FRASER: PRESIDENT

Thank you very much indeed Dr. Solomon for the presentation of the paper and the response to the questions put to you. This paper has taken up the allocated time which shows the value it has to our Association. We greatly appreciate the effort put into the preparation and presentation of your paper and as a token of thanks I would ask you to accept this AMEU tie.

# REPORT OF THE SECRETARY FOR THE YEARS 1979 AND 1980

# VERSLAG VAN DIE SEKRETARIS VIR DIE JARE 1979 EN 1980

On behalf of the Executive Council of the Association of Municipal Electricity Undertakings of South Africa, I take pleasure in submitting the following condensed report of the activities of the AMEU for the financial years of 1979 and 1980.

Namens die Uitvoerende Raad van die Vereniging van Elektriesiteitsondernemings van Suid-Afrika lê ek met genoë die volgende beknopte verslag van die aktiwiteite van die VMEO vir die finansiële jare 1979 en 1980 aan u voor.

## EXECUTIVE COUNCIL 1 UITVOERENDE RAAD

Together with their Councillor Members, who are nominated by the electricity undertakings, the following eleven Engineer Members were elected to the Executive Council at the 46th Convention held in Johannesburg in 1979:

P. J. Botes	—	Roodepoort
D. H. Fraser	—	Durban
W. Barnard	—	Johannesburg
D. C. Falser	—	Cape Town/Kaapstad
W. Bozyczko	—	Estcourt
J. D. Dawson	—	Uitenhage
A. H. L. Fortmann	—	Boksburg
J. A. Louber	—	Benoni
E. de C. Pretorius	—	Potchefstroom
K. G. Robson	—	East London/Oos Londen
J. K. von Ahlften	—	Springs

The Executive Council met five times, whilst the Standing Committee held four meetings.

Tesame met hul Raadslede wat deur die betrokke elektriesiteitsondernemings genomineer word, is die volgende elf Ingenieurslede tydens die 46ste Konvensie gehou te Johannesburg in 1979 gekies tot die Uitvoerende Raad:

—	President
—	President Elect
—	Aangewese President
—	Standing Committee
—	Dagbestuurslid
—	Standing Committee
—	Dagbestuurslid

Die Uitvoerende Raad het vyf keer vergader, terwyl die Dagbestuur vier keer byeengekom het.

## BRANCHES 2 TAKKE

### 2.1

A fifth Branch viz. Free State-Northern Cape was established. The boundaries of the Branch embrace Vrede, Harrismith, Wepener, Zastron, Aliwal North, Britstown, Carnarvon, Kenhardt, Upington, Vryburg, Kimberley, and Viljoenskroon. Bloemfontein is the central meeting place for the 18 members. The first executive comprised the following:

N. S. Botha	—	Chairman/Voorsitter	Bloemfontein
J. Botha	—	Vice Chairman/Ondervoorsitter	Welkom
J. Grobler	—	Secretary/Sekretaris	Bethlehem

The other four branches were all functioning and their office bearers were as follows:—

'n Vyfde Tak t.w. Vrystaat-Noord Kaapland het tot stand gekom. Die Tak se grense strek oor Vrede, Harrismith, Wepener, Zastron, Aliwal Noord, Britstown, Carnarvon, Kenhardt, Upington, Vryburg, Kimberley en Viljoenskroon. Bloemfontein is die sentrale bymekaarkomplek vir die 18 lede. Die eerste bestuur is soos volg saamgestel:

Die ander vier takke het nog steeds gefunksioneer en hul ampsdraers was soos volg:—

### 2.2

#### Highveld Branch/Hoëveld-tak

Chairman/Voorsitter	—	D. E. T. Potgieter	Verwoerdburg
Vice-Chairman/Ondervoorsitter	—	G. J. Nortje	Germiston
Secretary/Sekretaris	—	L. D. M. de Wet	Brakpan

### 2.3

#### Good Hope Branch/Goeiehoop-tak

Chairman/Voorsitter	—	J. A. Venter	Cape Town/Kaapstad
Secretary/Sekretaris	—	A. C. T. Frantz	Cape Town/Kaapstad
		Hon. Member/Erelid	

### 2.4

#### Natal Branch/Natal-tak

Chairman/Voorsitter	—	W. Bozyczko	Estcourt
---------------------	---	-------------	----------

## Eastern Cape Branch/Oos-Kaaplandse-tak

Chairman/Voorsitter — D. Haigh-Smith

Queenstown

## 3

## COMMITTEES

## KOMITEES

The following subcommittees were appointed by the Executive Council:—

Die volgende onderkomitees was benoem deur die Uitvoerende Raad:—

## 3.1

## Standing Committee/Dagbestuur

P. J. Botes together with his councillor

D. H. Fraser saam met sy raadslid

W. Barnard

D. C. Palser

## 3.2

## Papers Committee/Referatekomitee

P. J. Botes

D. H. Fraser

## 3.3

## Finance Committee/Finanskomitee

W. Barnard — Convenor/Sameroeper

J. K. von Ahlften

## 3.4

## Ad Hoc Committee: Revision of the Constitution

## Ad Hoc-Komitee: Hersiening van die Grondwet

W. Barnard — Convenor/Sameroeper

D. H. Fraser

E. de C. Pretorius

K. G. Robson

D. C. Palser

Clr. A. K. Shepstone

## 3.5

## Recommendations Committee for New Electrical Commodities

## Aanbevelingskomitee vir Nuwe Elektriese Verbruiksware

P. J. Botes — Convenor/Sameroeper

J. A. Loubser

B. van der Walt

tesame met verteenwoordigers van ander organisasies

## 3.6

## Escom Committee/Evkom-Komitee

W. Barnard — Convenor/Sameroeper

P. J. Botes

D. H. Fraser

D. C. Palser

K. G. Robson

## 3.7

## SABS Co-Ordinating Committee

## Koördinerende Komitee: SABS

E. de C. Pretorius — Convenor/Sameroeper

J. A. Loubser

J. K. von Ahlften

## 3.8

## Technical Training Committee

## Komitee: Tegniese Opleiding

D. H. Fraser — Convenor/Sameroeper

J. D. Dawson

A. H. L. Fortmann

J. A. Loubser

D. C. Palser

## 3.9

## Electrical Wiremen and Contractors Amendment Act

## Wysigingswet op Elektrotegniese Draadwerkers en Aannemers

J. K. von Ahlften — Convenor/Sameroeper

E. de C. Pretorius

3.10

Electrical Wiremen Registration Board  
Registrasieraad vir Elektrotegniese Draadwerkers  
J. K. von Ahlften — Statutory/Statutêr

3.11

Committee: Code of Practice for Earthing  
Komitee: Gebruikskode vir Aarding  
W. Barnard — Convenor/Sameroeper

3.12

Ad Hoc Committee to Investigate Legislation and Practices for Electrical Wiring Work in SA  
Ad Hoc-Komitee om Ondersoek in te stel na Wetgewing en Gebruik vir Elektriese Bedradingswerk in SA  
J. K. von Ahlften — Convenor/Sameroeper  
D. H. Fraser  
E. de C. Pretorius  
tesame met verteenwoordigers van ander organisasies

3.13

AMEU/ECA Liaison Subcommittee  
VMEQ/EKV-Skakelkomitee  
J. K. von Ahlften — Convenor/Sameroeper  
D. H. Fraser  
E. de C. Pretorius

3.14

Electrolytic Corrosion Committees  
Komitees: Elektrolitiese Korrosie

3.14.1

Main Committee/Hoofkomitee  
A. H. L. Fortmann

3.14.2

Witwatersrand Region/Witwatersandse Streek  
A. H. L. Fortmann

3.14.3

Natal Region/Natalstreek  
W. Bozyczko

3.14.4

Northern Cape Region/Noord-Kaaplandse Streek  
C. Vosloo

3.14.5

Western Cape Region/Wes-Kaaplandse Streek  
D. C. Palser

3.14.6

Cape Eastern Region/Oos-Kaaplandse Streek  
J. D. Dawson

3.15

High Voltage Co-Ordinating Committee  
Koördinerende Hoogspanningskomitee  
W. Barnard

3.16

World Energy Conference/Wêreldkragbronkonferensie  
W. Barnard

3.17

CSIR/NEERI Advisory Committee  
WNNR/NEEI-Advieskomitee  
W. Barnard



CSIR/NBRI Advisory Committee  
WNNR/NBNL-Advieskomitee  
P. J. Botes

NBRI Working Subcommittee for Electrical Distribution  
NBNI Werke-Onderkomitee vir Elektriese Distribusie  
J. K. von Alhften — Convener/Sameroeper  
J. D. Dawson  
D. H. Fraser (Alt D. R. Hill)  
J. A. Loubser  
A. H. L. Fortmann  
D. C. Palser (Alt K. J. Murphy)

NBRI Steering Committee on Rational Norms vir Township Services  
NBNI Loodskomitee vir Rasionele Norme vir Stedelike Dienste  
J. K. von Alhften

CSIR Solar Energy Subcommittee  
WNNR Sonenergie Onderkomitee  
D. C. Palser  
W. Barnard (Alt)

SANCI/SANKV  
A. H. L. Fortmann

## MEMBERSHIP 4 LIDMAATSKAP

The membership of the AMEU as at 31 December 1980 was as follows: Die ledetal van die VMEO op 31 Desember 1980 was soos volg:

Honorary Members/Erelede	29
Past Members/Voormalige lede	31
Engineer Members/Ingenieur lede	94
Associates/Geassosieerdes	23
Associate Members/Assosiaatlede	43
Local Authorities/Plaaslike Besture	162
Affiliates/Geaffilieerdes	121
Grand Total/Groot Totaal	503

## Obituaries 4.2 Doodsberigte

We regret having to record the following deaths:  
D. A. Bradley, J. E. Mitchell, (Past President and Honorary Member) D. M. Nobbs.

Dit spyt ons om te rapporteer dat ons kennis gekry het van die volgende afterwes: D. A. Bradley, J. E. Mitchell, (Oud-President en Ereleid) D. M. Nobbs.

## MEMBER MEETINGS 5 LEDE-BYEEKOMSTE

## Convention 5.1 Konvensie

The 46th Convention held in Johannesburg from 27 February to 1 March 1979 was attended by 543 delegates and ladies.

This Convention was in various ways an historic meeting. Although Roodepoort City Council was the host the Convention took place in the RAU Auditorium, Johannesburg.

The Secretary of the AMEU, as a City Councillor and Mayor of Roodepoort had to welcome the delegates to the Convention and officiated in that capacity at the civic braai.

Die 46ste Konvensie is deur 543 afgevaardigdes en dames vanaf 27 Februarie tot 1 Maart 1979 in Johannesburg bygewoon.

Hierdie Konvensie was in meer as een opsig 'n geskiedkundige byeenkoms. Alhoewel die Stadsraad van Roodepoort die gasheer was, het die Konvensie in die RAU, Johannesburg plaasgevind.

Die Sekretaris van die VMEO in sy hoedanigheid as 'n stadsraadslid en Burgemeester van Roodepoort het die afgevaardigdes na die Konvensie verwelkom en het in die hoedanigheid opgetree tydens die burgerlike braaivleis.

Mr. Piet Botes, City Electrical Engineer of Roodepoort was elected as President of the AMEU at this Convention.

It was a most successful Convention as appears from the published Proceedings.

Mnr. Piet Botes, Stadselktrotegniese Ingenieur van Roodepoort is op die Konvensie verkies tot President van die VME0. Dit was 'n besonder geslaagde Konvensie soos blyk uit die gepubliseerde Verrigtinge.

#### Technical Meeting 5.2 Tegniese Vergadering

A most interesting programme was arranged. The printed Proceedings contain the papers read and members' discussions.

'n Baie interessante program was aangebied. Die gedrukte Verrigtinge bevat die referate en ledeforum-besprekings.

#### Working Groups and International Conferences

It is the policy of the Executive Council that the AMEU be represented as far as possible at international and local meetings concerning the work of the Undertakings. For instance, the International Electrotechnical Commission (IEC) is the organisation responsible for world-wide standardization in the electrical and electronics fields. It has forty-three National Committees, which as far as possible are fully representative of all electrotechnical interests in their respective countries.

The IEC standards are used as the basis of national electrotechnical standards in so far as local customs and conditions permit. They are also often used directly in international trade.

The Executive Council has sent the following delegates to represent the AMEU at the respective meetings:

- 44th General Meeting of IEC held in Australia from 21 May to 1 June 1979 — Mr. J. A. Loubser.  
45th General Meeting of IEC held in Stockholm, Sweden from 2 to 14 June 1980 — Messrs P. J. Botes and B. van der Walt.  
IFAC Symposium held in Pretoria from 15 to 19 September 1980 — Messrs. P. J. Botes, W. Barnard and A. H. L. Fortmann.  
World Energy Conference held in Munich, West Germany during September 1980 — Mr. W. Barnard.  
TC64 of the IEC held in Pretoria from 13-17 October 1980 — Messrs. J. D. Dawson and J. A. Loubser.

#### 6 Werkgroepe en Internasionale Konferensies

Dit is die beleid van die Uitvoerende Raad dat die VME0, so ver as moontlik, verteenwoordig moet wees op internasionale en plaaslike byeenkomste rakende die aktiwiteite van die Ondernemings. So bv. is die Internasionale Elektrotegniese Kommissie (IEK) verantwoordelik vir die wêreldwye standaardisasie in die elektriese en elektroniese veld. Die organisasie se ledeetal bestaan uit 43 Nasionale Komitees, van wie dit verwag word om ten volle verteenwoordigend te wees van alle elektrotegniese belange in hul onderskeie lande. Die IEK-standaarde word gebruik as die basis van nasionale elektrotegniese standaarde (vir sover plaaslike gebruik en toestande dit toelaat). Dit word ook gereeld direk in die handel gebruik. Die Uitvoerende Raad het die volgende afvaardigings na die onderskeie byeenkomste gestuur om die VME0 te verteenwoordig:

- 6.1 44ste Algemene Vergadering IEK gehou in Australië van 21 Mei tot 1 Junie 1979 — mnr. J. A. Loubser.  
6.2 45ste Algemene Vergadering IEK gehou in Stockholm, Swede van 2 tot 14 Junie 1980 — mnr. P. J. Botes en B. van der Walt.  
6.3 'IFAC'-simposium gehou te Pretoria van 15 tot 19 September 1980 — mnr. P. J. Botes, W. Barnard en A. H. L. Fortmann.  
6.4 Wêreldkragbronkonferensie gehou in München, Wes-Duitsland gedurende September 1980 — mnr. W. Barnard.  
TK64 van die IEK gehou te Pretoria van 13-17 Oktober 1980 — mnr. J. D. Dawson en J. A. Loubser.

#### PUBLICITY 7 PUBLISITEIT

The AMEU publishes the following:  
Convention Proceedings  
Technical Meeting Proceedings  
Recommendations by the Approvals Committee  
The "Municipal Administration and Engineering" is still used as the official organ of the AMEU.

We wish to thank all our advertisers who consistently supported our journals.

Die VME0 publiseer die volgende:  
Konvensie Verrigtinge  
Tegniese Vergadering Verrigtinge  
Aanbevelingsdeur die Aanbevelingskomitee  
Die "Munisipale Administrasie en Ingenieurswese" word steeds as die amptelike orgaan van die VME0 gebruik.  
Ons wil graag ons adverteerders wat gereeld ons joernale ondersteun het van harte bedank.

This report should be read in conjunction with the reports of the various committees and/or representatives. The considerable time sacrificed by the representatives and the appreciable amount of work put in by them must specially be mentioned. The aid given in this way is of incalculable value to the AMEU and its members and, on behalf of the members, we express our gratitude for the selfless service.

The Executive Council at all times endeavoured to serve the interests of local authorities to the best of its ability.

We gladly extend our thanks to all organisations with whom the AMEU maintains close contact for their goodwill and collaboration.

**BENNIE VAN DER WALT  
SEKRETARIS/SECRETARY**

**MNR. BENNIE VAN DER WALT: SEKRETARIS**

Mr. President, please allow me this opportunity to add my felicitations to those of the others who have congratulated you on your election as President of the AMEU. I trust that you will enjoy good health and a most successful term of office. My good wishes also to our President Elect, Wessel Barnard.

Meneer, ek sal nie reg laat geskied indien ek hierdie geleentheid sou verby laat gaan sonder om my dank en waardering te betuig teenoor die volgende persone en instansies:

Die pas uitgetrede President, Mnr. Piet Botes, met wie ek baie hartlik kon saamwerk. Piet, baie, baie dankie vir al jou hulp en ondersteuning en dat ons as span kon saamtrek.

Die Uitvoerende Raad van die VMEQ vir hul simpatieke samewerking om die masjinerie van die organisasie glad te laat verloop. Die VMEQ as 'n organisasie kan voorwaar trots wees op al die lede van die Uitvoerende Raad wat 'n reuse aandeel het in die sukses van die uitbouing van hierdie organisasie.

I am, Sir, also very deeply indebted to our Affiliates who so readily and willingly support the AMEU by virtually sponsoring the printed proceedings through the means of their advertisement contributions. I am sure you will all agree that his has lifted the quality of the annual proceedings to that of a prestigious publication. Thank you once again.

Then there are various Affiliates who, through the years, assisted and co-operated with us very closely. Thank you all very much for your kind assistance so generously given.

Mnr. die President, om my storie af te sluit moet ek verwoys na die finansiële komitee wat bestaan het uit mnr. Wessel Barnard en Jules von Ahlfen. My dank en waardering aan Wessel en Jules vir hulle samewerking te alle tye in die Finanskomitee.

Vriende ook aan u een en almal wat per telefoon kontak gemaak het met ons. Onthou u het die kantoor in Johannesburg en ons sal u graag behulpsaam wees. Ek dank u.

**MR. D. H. FRASER: PRESIDENT**

Baie dankie mnr. die Sekretaris.

The Secretary's report is now open for any comment, questions or discussions.

**MR. J. K. VON AHLFTEN: SPRINGS**

Mr. President, I take it "Approvals Committee" referred to in item 3.5 should be "Recommendations Committee"?

Hierdie verslag moet saamegeles word met die verskillende komitees en/of verteenwoordigers se verslae. Daar dien vermeld te word dat 'n aansienlike hoeveelheid tyd deur die verteenwoordigers opgeoffer en heelwat werk gelewer is. Die hulp wat aldu verleen word, is van onskatbare waarde vir die VMEQ en sy lede en ons betuig namens die lede dank vir daardie onbaatsugtige dienste.

Die Uitvoerende Raad het te alle tye getrag om die belange van die plaaslike besture en sy lede na die beste van sy vermoë te dien.

Graag bedank ons ook alle instansies met wie die VMEQ 'n noue verbintenis het vir hulle goeie verstandhouding en samewerking.

**MR. D. H. FRASER: PRESIDENT**

Thank you Mr. von Ahlfen. If there are no other comments, I will now ask Mr. Botes to propose the adoption of the secretarial report.

**MNR. P. J. BOTES: ROODEPOORT**

Meneer die President, dit is vir my 'n besondere voorreg om oor die verslag van die Sekretaris kommentaar te lewer.

Besonders omdat ek die voorreg het om kommentaar te lewer op die verslag van 'n raadslid van my. Dit is nie aldag dat die voorreg 'n amptenaar te beurt val nie. Dadelik wil ek maar byvoeg dat ek bevoorreg was om gedurende my dien tydperk, by tye 'n burgemeester van my stad, raadslid van my stad, as sekretaris van die Vereniging gehad het.

Die afgelope 2 jaar en seker omdat ons mekaar so goed ken, het ons seker albei ons sokkies opgetrek. Bennie het heelwat administratiewe probleme gehad, o.a. om 'n tikster te bekom oor die tydperk en dit laat my onwillekeurig dink aan die volgende grappie:

It reminds me Mr. President of the private secretary who told the boss early on Monday morning that she had good and bad news for him, but that he did not have to choose which one he wanted to hear first, because she could give both to him in a single sentence. She said "you are not sterile".

Die verslag voor u is 'n baie feitlike verslag en van belang is die feit dat 13 Plaaslike Besture oor die afgelope jaar aansluiting het, asook 11 geaffilieerdes. Dit is 'n besondere prestasie wat aantoon die steeds groeiende belangstelling in 'n lewendige en goed-bestuurde organisasie.

Dit is nie vir my nodig om die vermoëns van die Sekretaris te besing nie, want diegene wat al President van die Vereniging was, sal getuig van sy deeglike organisasievermoë. Hier dien gemeld te word die organisasie van die konvensie by die Randse Afrikaanse Universiteit en die tegniese vergadering by Welkom. Niks word aan die voorsienigheid oorge-laai nie en elke reëling is 'n sukses, soos u weer tydens hierdie Konvensie sal ervaar.

Sy finansiële "expertise", die finansiële state oor die afgelope paar jaar vandat hy as sekretaris oorgeneem het, spreek vir hulself en sy sekretariële dienste is puik.

Behalwe vir die Uitvoerende Komitee en die Dagbestuur dien uitvoerende raadslede op 25 verskillende komitees. Dit verg volgehoue aandag en tyd asook die noodsaaklike opvolgwerk wat dit bykans onmoontlik maak vir 'n uitvoerende komiteelid om benewens sy gewone pligte nog al hierdie pligte nog al

hierdie pligte ook te doen. Die vergroting van die aantal uitvoerende komiteede deur die toevoeging van voormalige presidente sal in 'n mate die las verlig.

Van belang is die stigting van 'n tak in die Vrystaat en Noordkaap wat ek reeds in my verwelkoming genoem het. Ek was bevoorreg om die eerste 2 vergaderings van die tak by te woon en kan getuig van die entoesiasme van die betrok-

kenes. Ons wens hulle alle sukses toe in die toekoms.

Die Status van die VMEGO groei by die dag en ons moet steeds voortbou om dit die Vereniging in die land te maak. Daar is egter nog baie werk en samewerking met ander instansies moet uitgebrei word maar die VMEGO moet nou ook leiding neem met die daarstelling van handleidings en daar is 'n groot nood.

## FINANCIAL REPORT

The Association had an excess of income over expenditure of R4 008,07 for the year ended 31 December 1980. This is a very satisfactory result and the Executive Council has resolved that the Attendance Fees and Subscriptions remain unaltered for 1981.

You will agree that in these inflationary times, this reflects great credit on our financial manager and secretary, Bennie van der Walt.

It is of interest to note that the Association's main income is made up as follows:—

Subscriptions and Convention attendance fees	R26 246,00
Interest on Investments	R11 301,53
Publications and Advertisements	R 4 918,10

It is particularly pleasing to note that for the first time the Association has been able to grant a University scholarship of R1 000 p.a. over the past two years and allocated a total of R2 550 to the Technikon and Training Centres for merit awards during 1980.

The commitment of the AMEU on the various Standards and Research Institutes and many other ad hoc committees and conferences in the Republic and overseas has considerably increased in recent years, resulting in substantially increased expenditure. The Association is, however, in the fortunate position that these expenses can be largely met from interest on investments, but the Association's funds will have to continue to be carefully managed as in the past.

Copies of the Auditors' Report and the Financial Statements are available to members from the Secretary on request.

### MR. W. BARNARD: JOHANNESBURG

Mr. President, Ladies and Gentlemen, I would also like to express my appreciation to Bennie van der Walt and Jules von Ahlfen who have worked with me in trying to control the finances.

It is pleasing to be able to say that the finances of the Association is on a sound footing with a modest surplus and as a result of this the Executive Council have decided that the fees for the various members will be unaltered for the following year, which I think is quite an achievement in this time of rampant inflation.

As mentioned by Mr. van der Walt, the Association is taking on greater and greater commitments, and a lot of these commitments are on international committees. I think this is a move in the right direction. I know my own City Council in Johannesburg strongly support the participation of this Country and its engineering professions in international organisations. They are still limited but nevertheless we are participating in various fields and the members will know that a few years ago the CIE Committee was held in Moscow and we were represented in Moscow by Mr. Ken Robson. I represented the AMEU in other Countries as well. The point I am making is that these are commitments which are being taken on by the AMEU and it does require substantial cost, but nevertheless the Association with its very excellent management under Bennie van der Walt has managed to contain these costs and as you will see from my brief report, our investments are able to cover these expenses. I only have one regret that I have not been able to talk Bennie van der Walt

## FINANSIËLE VERSLAG

Die Vereniging het 'n oorskot van inkomste bo uitgawe van R4 008,07 vir die jaar geëindig 31 Desember 1980. Dit is 'n baie bevredigende resultaat en die Uitvoerende Raad het besluit dat die registrasiegelede en ledegelede onveranderd bly vir 1981.

U sal saamstem dat in hierdie inflasionistiese tye alle eer toekom aan ons finansiële bestuurder en sekretaris, Bennie van der Walt.

Dit is van belang om kennis te neem dat die Vereniging se hoof inkomste soos volg opgemaak is:—

Ledegelede en Konvensie-registrasiegelede	R26 246,00
Rente op Beleggings	R11 301,53
Publikasies en Advertensies	R 4 918,10

In besonder is dit van belang om kennis te neem dat die Vereniging vir die eerste keer in staat gestel was om 'n Universiteitsbeurs van R1 000 p.j. oor die afgelope twee jaar en 'n totaal van R2 550 vir 1980 beskikbaar gestel aan Technikon en Opleidingsentrums vir meriete toekennings.

Die verpligtinge van die VMEGO op die anderseke Standaarde en Navorsingsinstitute en baie ad hoc komitees en konferensies in die Republiek en oorsee het aansienlik toegeneem in onlangse jare, met 'n gevolglike aansienlike toename in uitgawe. Die Vereniging is gelukkig in die goeie posisie dat die uitgawe hoofsaaklik gedek word uit rente op beleggings, maar die Vereniging se fondse moet steeds met omsigtigheid bestuur word soos in die verlede.

Afskrifte van die Ouditursverslag en die Finansiële State is beskikbaar aan lede by Sekretaris op aanvraag.

### W. BARNARD CONVENOR/SAAMROEPER FINANCE COMMITTEE/FINANSKOMITEE

into investing some of our money in gold shares, strictly on the advice of my Chairman of the Management Committee, but perhaps when one looks at the shares at the moment, it might have been a good decision.

Mr. President, finally the copies of the Auditors' report are available to members. Thank you.

### PROF. DR. P. J. BOTHA: POTCHEFSTROOM

Geagte meneer die President, dames en here, u weet, ek is in 'n moeilike posisie want van boekhou weet ek 'n min soos die sprekewoordelike 'kat van safran' en nou is ek in die posisie dat ek vanoggend hier moet kommentaar lewer op Mnr. van der Walt en sy helpers se boekhouding. Ek het 'n bietjie gekyk na die finansiële state. Die totale inkomste vir 1980 was R49 699,86; die totale uitgawes R45 691,79, wat vir ons 'n surplus van inkomste bo uitgawe lewer van R4 008,07. Dit is 'n heel bevredigende toedrag van sake, en mnr. Barnard het ook genoem in sy verslag dat die Uitvoerende Raad besluit het om as gevolg daarvan die ledegelede nie te verhoog nie. Die grootste bron van inkomste was maar die ledegelede wat R22 005 ingebring het — dit wil sê, 46% van die totaal. Die tweede grootste bron was advertensies met R11 610 — 'n bietjie meer as 23% van die totaal, en die derde grootste bron van inkomste was die rente op beleggings wat feitlik net so groot was as die advertensies, ook byna 23%. Hierdie drie items saam, naamlik die ledegelede, advertensies en rente op beleggings bedra 92% van die Vereniging se inkomste.

Die grootste bron van uitgawe was die werksgeroepe en verwante bedrywighede met R11 769 en dan was daar ook heel-

wat reiskoste omdat die Vereniging sy bedrywighede heelwat uitgebrei het, veral ten opsigte van standaard komitees en navorsingsinstitute en ook ten opsigte van konferensies sowel binne- as buitelandse en dit is 'n baie belangrike saak. U weet waar ons in die buiteland so baie geboikot word wat ons bedrywighede betref, moet ons daar waar ons nog 'n sé het, ons plek behou, en dit is uiters belangrik dat ons so ver as ons finansiële vermoë dit toelaat, hierdie konferensies buitelandse sal bywoon en ons beeld daar sal uitdra.

'n Ander saak wat ook van besondere betekenis is, is dat die Vereniging in die afgelope twee jaar beurse van R1 600 toegeken het vir universiteitsopleiding. Dit afgesien van R2 250 wat die afgelope jaar in meriete-toekennings gemaak is aan Technikon en opleidingsentrums. Daarmee het die Vereniging hom definitief op die weg geplaas om die opleiding van tegniese personeel te bevorder wat myns insiens 'n baie verbydende saak is. U weet, met die geweldige mannekragtekort moet die Vereniging sy plig ook daar nakom om die tegniese personeel te versterk.

Meneer die President, ek is seker dat al die afgevaardigdes met my sal saamstem as ek 'n hartlike woord van dank en waardering aan Mr. van der Walt rig vir die belwame wyse waarop hy die finansiële sake van ons Vereniging behartig het. Aan meneer Wessel Barnard en Jules van Ahlfen wat as die finansiële komitee behulpsaam was baie dankie vir julle leiding wat julle in die verband gegee het.

Meneer die President, die boeke van die Vereniging is behoorlik ge-ouditeer en in orde bevind, en dit is vir my aangenaam om te kan voorstel dat die verslag aanvaar word.

**MR. M. CLARKE: RANDBURG**

Mr. President. Just a question. I think all members will be very interested to know if we can get a list from time to time, possibly at the Convention, of people to whom these awards have been made, including bursaries to the Technikon and Universities. I, for example, would be happy to give preference to applicants if I knew in advance that they had received an award from us.

## **REPORT OF THE RECOMMENDATIONS COMMITTEE FOR NEW ELECTRICAL COMMODITIES 1979-1980**

### **1. HISTORY**

At the request of the AMEU in 1948, the SABS formed a committee called "The Committee for Approval of New Electrical Products". The purpose of this committee was to examine and report on new and untried electrical products for which no national standard specification exists. However, there was a certain amount of misunderstanding of the committee's decisions on the part of firms submitting products owing to the fact that the Bureau carried out the necessary secretarial work and there had been a tendency to assume that favourable recommendation by this committee meant approval by the Bureau.

In view of the fact that it was primarily for the benefit of AMEU members and because of the misinterpretations of its relation to the Bureau it was felt that the time had arrived for the AMEU to take over the organisation of the committee. The AMEU was to undertake the secretarial work involved and the Bureau would continue to carry out any tests or inspections of products which might be necessary. The AMEU took over this committee at its meeting dated 4 March 1954 and renamed it "Recommendations Committee for New Electrical Commodities".

Certain problems were experienced with the term "approved" and it was then decided to use the term "The committee considers this article suitable for use".

At its meeting dated 2 December 1968, in consultation with the Bureau, it was decided that the Recommendations Committee should confine itself to fixed installations only, and that the Bureau be given jurisdiction over all plug-in appliances.

**MR. W. BARNARD: JOHANNESBURG**

Mr. President, we will certainly include that in future years, but I would like to take this opportunity to mention that we are disappointed at the poor response we get in applications for bursaries, particularly university bursaries. We are offering people R1 000 without any commitment. Nevertheless, over the last couple of years, we have only had one application and we have given one bursary to the same student in two subsequent years. We are prepared to offer more than one bursary.

We have approached the Universities and we have gone further now and asked whether we would be permitted to put our own notices up at the Universities, but I think it is something which should get a bit more publicity because these bursaries are available, but they are not being fully utilised. Thank you.

**MR. K. G. ROBSON: EAST LONDON**

Mr. President, this may not be a practicable suggestion or proposal, but it did occur to me that, if it possible from time to time to use the floor of these Conventions and the Technical Meetings to make one or two of the awards to deserving students. It may be possible, particularly in Johannesburg, where there is the likelihood of a bursar being there or an apprentice who has received an award, to invite him along and possibly a Council representative and to make the presentation during the session.

We were delighted to receive the R100 cheque for our apprentice training centre at East London and we are having the award made by the Mayor next month. But perhaps we should use this forum to make a public demonstration of this system, if it is possible.

**MR. D. H. FRASER: PRESIDENT**

Thank you for that suggestion Mr. Robson, we will certainly give it consideration.

## **VERSLAG VAN DIE AANBEVELINGSKOMITEE VIR NUWE ELEKTRIESE TOEBEHORE 1979-1980**

### **1. GESKIEDENIS**

In 1948 op aandrang van die VMEQ het die SABS 'n komitee wat bekend gestaan het as "Die Komitee vir die Goedkeuring van Nuwe Elektriese Produkte" in die lewe geroep. Die doel van die komitee was om ondersoek in te stel en verslag te doen oor nuwe onbeproeft elektriese produkte waarvoor daar nie 'n nasionale standaardspesifikasie bestaan nie. Omdat die Buro die sekretêriële werk gedoen het, het 'n misverstand ontstaan omdat die vervaardigers van opinie was dat goedkeuring van hierdie komitee ook beteken goedkeuring alle inprop-kommoditeite.

Aangesien die werking van hierdie komitee hoofsaaklik tot voordeel van VMEQ-lede was en om misverstande m.b.t. die Buro van Standaarde uit die weg te ruim, is besluit om die komitee onder die jurisdiksie van die VMEQ te plaas en dat die sekretêriële werk deur die VMEQ behartig sal word. Die Buro sal nog voortgaan om enige toetse en inspeksies op produkte wat nodig mag wees, uit te voer. Die komitee het na oorname deur die VMEQ vanaf 4 Maart 1954 bekend gestaan as "Die Aanbevelingskomitee vir Nuwe Elektriese Toebehore".

Aangesien daar ook probleme opgeduik het met die term "goedgekeur" is besluit dat die term "Hierdie komitee beskou die artikel as goed genoeg vir gebruik", gebruik sal word.

Op sy vergadering gehou op 2 Desember 1968, is in ooreenstemming met die Buro besluit dat die Aanbevelingskomitee homself sal beperk tot nuwe elektriese toebehore vir gebruik in vaste installasies alleenlik en dat die Buro jurisdiksie sal hê oor alle inprop-kommoditeite.

## 2. FUTURE

In 1969 the SABS advised that, with the taking over of the "Wiring Regulations Committee" by the Bureau, it was felt that the function of the Committee should be re-assessed in an endeavour to streamline the whole procedure, and that the secretarial work be taken over by the Bureau again.

The Council of the SABS approved the Code of Practice for the Wiring of Premises (SABS 0142-1978) on 8 March 1978. The authorisation on the use of electrical equipment and techniques in terms of the New Code was vested in the Bureau and the method of application for authorisation is prescribed in annexure "G" of the Code.

Because of certain legal interpretations the Code could not be published under the various ordinances and although the Code was adopted by most of the AMEU members, as from 1 January 1980 (without legal backing), the Recommendations Committee is still functioning. It is therefore important that the AMEU should decide on the future of the Recommendations Committee and the following proposal should be considered —

That the "Recommendations Committee" be replaced by an "Authorisation Committee".

The present committee only recommends that an item is or is not safe enough for use and it is left to the individual Electricity Supply Authority to decide whether or not the article will be permitted on its system. If an "Authorisation Committee" issues an authorisation, the Electricity Supply Authority will have no choice but to allow the item concerned to be connected on its system.

## 3. REPRESENTATION

The members on this committee comprise representatives of the AMEU, SAIEE, ESCOM, SABS, EEAIA, SAACE, ECA (SA), Johannesburg Electricity Department and the Post Office. During the past year we took leave of Mr. F. J. Prins of the SABS, who retired, and also Mr. J. T. Williams, who represented the S.A. Institute of Electrical Engineers. These gentlemen served for years on this committee and we would like to express our thanks and gratitude for work done by them. Mr. Williams first attended a meeting on 16 June 1961 and Mr. Prins on 25 September 1969.

## 4. ACTIVITIES

Eight ordinary meetings and one special meeting were held during this period to consider new wiring systems.

Datum Date	Aantal goedgek. No. appr.	Aantal terugverw. No. deferred	Aantal nie goedgekeur. No. not appr.	Additional requirement Bykomende vereiste
1979-05-03	4	3	—	1
1979-08-23	1	2	1	—
1979-11-01	2	4	1	1
1980-02-14	3	5	—	—
1980-05-01	4	3	1	—
1980-08-07	6	3	1	—
1980-11-13	3	—	1	1
<b>TOTAL/TOTAAL</b>	<b>23</b>	<b>20</b>	<b>5</b>	<b>3</b>

## 5. WIRING SYSTEMS

During the special meeting held on 22 March 1979, a report from the Bureau (WG 4), comprising Document No. 60, regarding wiring systems, was considered. The approval of these systems is summarised in SABS Documents No. 105 and 106 (WG 4), Project No. 751/5001.

## 6. CONCLUSION

The whole-hearted co-operation of the committee members as well as their cordial support has been a feature of the working of this committee over the past two years.

## 2. TOEKOMS

Reeds in 1969 het die SABS te kenne gegee dat, gesien in die lig van die oorname van die "Bedrading Regulasiekomitee" deur die Buro, die funksionering van hierdie komitee heroorweeg sal word in 'n poging om die gehele prosedure te verbeter en dat die sekretariese werk weer deur die Buro oorgeneem sal word.

Die Raad van die SABS het op 8 Maart 1978 die Gebruikskode vir die Bedrading van Persele (SABS 0142-1978) goedgekeur. Die magtiging vir die gebruik van elektriese toerusting en tegnieke berus gevolglik die Kode by die Buro en die metode van aansoek om magtiging word voorgeskryf in aanhangsel "G" van genoemde Kode.

Die Gebruikskode kon weens sekere wettlike interpretasies nie onder die verskeie ordonansies afgekondig word nie en alhoewel die Kode deur feitlik al die VME0-lede in gebruik geneem is vanaf 1 Januarie 1980 (sonder wettlike steun), funksioneer die Aanbevelingskomitee nog soos voorheen. Daar moet dus indringend deur die lede van die VME0 besluit word oor die voortbestaan van die Aanbevelingskomitee en die volgende feit moet ernstig oorweeg word —

Dat die "Aanbevelingskomitee" vervang gaan word deur 'n "Magtigingskomitee". D.w.s. die huidige komitee doen net aanbevelings of 'n item om veiligheidsredes geskik is vir gebruik en dit word aan die Elektriesiteitsvoorsieningsowerheid oorgelaat of hy die gebruik daarvan sal toelaat op sy stelsel. Wanneer die "Magtigingskomitee" 'n magtiging uitreik, het die Elektriesiteitsvoorsieningsowerheid geen keuse as om die item volgens die voorskrifte toe te laat nie.

## 3. VERTEENWOORDIGING

Die verteenwoordiging op hierdie komitee bestaan uit verteenwoordigers van die VME0, SAIEE, EVKOM, SABS, EIAN, SAVRI, ERV(SA), Johannesburgse Elektriesiteitsdepartement en HPK. Gedurende die afgelope jaar is afakeid geneem van mnr. F. J. Prins van die SABS, wat afgetroe het, en mnr. J. T. Williams wat die S.A. Instituut van Elektro-tegniese Ingenieurs verteenwoordig het. Hierdie persone het jarelank op die komitee gediens en langs hierdie weg wil ons ons dank aan hulle oordra vir die werk deur hulle verrig. Die eerste vergadering wat mnr. Williams bygewoon het, was 16 Junie 1961 en mnr. Prins 25 September 1969.

## 4. WERKSAAMHEDE

Agt gewone vergaderings is in hierdie tydperk gehou en een spesiale vergadering wat die nuwe bedradingstelsels oorweeg het.

## 5. BEDRADINGSTELSELS

Gedurende die spesiale vergadering wat op 22 Maart 1979 gehou is, is 'n verslag van die Buro (WG 4) dokumentnr. 60, wat handel oor nuwe bedradingstelsels, oorweeg. Die goedkeuring van hierdie stelsels is in SABS dokumentnr. 105 en 106 (WG 4), projeknr. 751/5001 saamgevat.

## 6. TEN SLOTTE

Ek kan getuig van goeie samewerking van komiteelede asook hulle gulhartige ondersteuning oor die afgelope twee jaar.

P. J. BOTES  
CONVENOR/SAMEROEPER

## MNR. P. J. BOTES: ROODEPOORT

Mnr. die President, sodra die gebruikskode vir die bedrading van perale wetlik afgekendig word, sal die magtiging in terme van die kode deur die SABS gedoen word. Tot tyd en wyl dit gaan gebeur sal hierdie komitee nog voortgaan met sy bedrywighede.

Soos in my verslag duidelik gestel, is die komitee 'n "aanbevelingskomitee" en het nie magtiging om enigets af te dwing nie. Hierdie toestand sal verval sodra die kode wetlik afgedwing word.

In sekere bulletins wat u van tyd tot tyd ontvang is daar gepraat van goedere wat "goedgekeur" is. U moet dit sien dat die komitee die items goedgevind het vir gebruik. U het nog u reg om die gebruik te weer.

Dit, mnr. die President, bring my by 'n belangrike aspek wat deur mnr. J. K. van Ahlfen onder my aandag gebring is. Moet 'n item wat deur hierdie komitee geskik gevind is vir gebruik deur alle voorsiensingsreghede nie aanvaar word nie, met die voorbehoud dat dit natuurlik nie 'n nadelige invloed op die elektrisiteitsvoevoer sal hê nie?

Dit is uiters noodsaaklik om sienswyse oor hierdie aspek aan te hoor en ek vertrou dat ons 'n vaste besluit kan neem. Voordat ons egter hieroor besin moet ons miskien eers mnr. Grant van die SABS se siening aanhoor. Ek wil net graag die Sekretaris en die lede van die komitee bedank vir hulle samewerking oor die afgelope 2 jaar. Dankie.

## MR. J. V. GRANT: SABS

I must congratulate Mr. Botes on his report, which gives the historical background to the setting-up of this committee, much of which was unknown to me and is most interesting. In this connection, I would also like to record that there has been very good co-operation between the committee and the Bureau, especially on the part of Mr. Botes himself, as Convenor over the last two years.

Turning now to the report itself, may I draw your attention to the last paragraph on the second page, where Mr. Botes has put a question to this Convention which can be summarized as follows: "What is the future of the Recommendations Committee"?

There has at times been some confusion about the functions of this committee in relation to the proposed authorization procedure which is described in Appendix G to the Wiring Code. I would like to put the facts in perspective in order that the Convention can come to a meaningful decision.

As stated by Mr. Botes, the main function of the Recommendations Committee is to examine new commodities for safety and to issue suitable recommendations on their use. The committee, however, is not empowered to recommend any

item, the use of which is prohibited by the code, whether by specific exclusion or by the lack of clearly applicable requirements. Amendment of the code could allow such items to be used.

Now, the Wiring Code: The Main Committee did not intend that innovations and the development of new techniques and equipment should be inhibited; neither did it wish to be continually amending the code. On the other hand, the Main Committee did wish to make the Wiring Code compulsory country-wide and, with his full support, decided to do this through the Chief Inspector of Factories, via an Act of Parliament. The solution to the problem of accepting innovative ideas, which conflict with the code, was to introduce the authorization procedure. It is thus possible for the statutory authority (i.e. the Chief Inspector of Factories) who makes the code compulsory to allow the adoption of such innovative ideas; indeed no other person can make such allowances. I do not intend to elaborate on this procedure, because I have no doubt that you have all read Appendix G to the code. I merely emphasize that the Chief Inspector of Factories will sign the authorization certificates; he is the ultimate authority even although the assessment of new techniques, etc. may be delegated to the Main Committee.

However, the authorization procedure was not intended to deal with those new items or techniques that clearly fall within the scope and the wording of the code. Such items might well be unsafe in one respect or another, so what is to be done about them? Domestic electrical appliances will be covered by the new compulsory safety specification and should all comply before sale to the public. The remaining items are therefore new non-domestic appliances and techniques, such as wiring systems. These could perhaps be assessed in terms of the authorization procedure because, if there is a lack of existing specification requirements and tests for a completely new technique, they can be drawn up in conjunction with the authorization certificate.

From my remarks, it might look as if there is little motivation for the continuation of the Recommendations Committee. I do feel, however, that it would be a great pity if it was disbanded. It can still function in its old capacity as a committee that issues recommendations in respect of the safety of commodities that do not conflict with the code and therefore deal with all aspects not covered by the authorization procedure. May I leave these thoughts with you for your final decision.

## MR. D. H. FRASER: PRESIDENT

Thank you Mr. Grant for that very helpful contribution. I think that the suggestions you have made and the thoughts you have put in our minds will have to be referred first to the Executive Council before we can come to any sort of decision.

## REPORT OF THE ESCOM COMMITTEE 1979-1980

1. The period under review was relatively quiet and it is hoped that the era of frequent large Escom tariff increases is something of the past.
2. Close liaison was maintained with Escom during this period and a number of meetings were held to discuss the structuring of Escom tariffs, with special reference to Escom charges for bulk supply to municipalities. Thus far no progress has been made in obtaining a special municipal bulk tariff at lower rates.
3. Escom amended their Rand and OFS Undertaking bulk tariff as from 1 July 1980. As local authorities in this area were affected to varying degrees depending on individual load factors, the AMEU was unable to make

formal representation to the Electricity Control Board on behalf of all members, but support was nevertheless given to those individual local authorities who lodged objections.

Resulting from the effect of the restructured Escom tariff on a number of municipal consumers, members have submitted memoranda on the need for a special municipal tariff. However, there appears to be no consensus on this issue and this matter will therefore be submitted to the Executive Council for further research and consideration.

4. A number of members of the Highveld Branch have recently experienced problems with load shedding on instructions from Escom. At the Branch's request, arrangements were made for an Escom official to address the Branch on Escom load shedding.

W. BARNARD, CONVENOR



**WHAT SOUTH AFRICA NEEDS**  
**IS A LITTLE MORE POWER SHARING.**

If the inhabitants of South Africa are bound by anything, it's a desire for economic growth. And if there's a power source that can help them fulfil that desire, it's Eskom. Eskom is one of the largest producers of electricity in the world. It generates 90% of the electricity used in South Africa. In fact almost 60% of the electricity used in the entire continent. But electricity isn't all Eskom generates. It contributes to the development of all people in South Africa. A development that will never be held up by a lack of sufficient power. Because by the year 2000 its power stations will produce over 4 times the current output. There's one kind of power that every man needs. The power that every man can share in. The power produced by Eskom.

**ESCOM — Electricity Supply Commission.**



## ESCOM COMMITTEE EVKOMKOMITEE



Mr. Ken Robson

### MR. D. C. PALSER: CAPE TOWN

Mr. President, in his report, Mr. Barnard refers to discussions with ESCOM on the question of a special municipal bulk tariff. This is a subject that has been raised frequently by at least one provincial municipal association and taken up, I believe, by the United Municipal Executive (UME), but with little progress to date. It would appear that, for any such appeal for a special tariff to succeed, it will be necessary to show that the load characteristics of municipal consumers as a group are different from those of any other group of consumers in the bulk consumer class. Because of the preponderance of domestic consumers the load pattern of municipalities is, however, generally markedly seasonal and, as a result, instead of achieving a low demand charge, a higher demand charge could well result through having to ensure an adequate recoupment of demand-related costs across the year.

I agree with Mr. Barnard, therefore, that this matter be pursued with due caution.

Another matter that has been taken up with ESCOM by the United Municipal Executive is the question of a uniform ESCOM tariff structure across the country. At present consumers in the northern part of the country benefit from lower rates than those further south because of the northern consumers' proximity to ESCOM's large and efficient power stations in the north. I understand, though, that it is ESCOM's intention to move progressively towards a uniform tariff structure across the country in response to changing cost structures. It would be interesting to know, therefore, if this is in fact still their policy and, if so, could an estimate be given of the likely time scale involved.

Finally, Mr. President, ESCOM has publicly announced that it expects a particularly difficult winter this year in meeting demand because of a severe shortage of generating capacity on its system and has accordingly requested the larger consumers across the country to assist with voluntary load shedding as may prove necessary at times.

I personally believe that it behoves all municipalities, in their own as well as in the national interest, to collaborate fully with ESCOM in this programme of voluntary load reduction. To my knowledge a number of municipalities, including my own, have already agreed to assist. If this is indeed the view of the majority of municipalities, and I am sure that it is, I would suggest, Mr. President, that this Convention formally acknowledge its support of this load reduction programme

and pledge its full co-operation in rendering all possible assistance to ESCOM this winter. Such support and co-operation cannot but be in the best interests of us all.

### CLR. F. OBERHOLZER: JOHANNESBURG

I have indicated here, Sir that we must go slowly in regard to this request. You know Municipalities, unlike the Government, have only one main taxing source of revenue and that is the rate fund. And the rates paid by individuals have reached the stage now where many pay more in rates than in income tax. The tariffs charged by Municipalities now exceed taxation on land as far as the home owner is concerned. So we have the difficulty that people are being loaded continually with increased tariffs and, when these tariffs emanate from ESCOM, the ordinary consumer does not understand that this is just a passing on of an increase by a extraneous body over which the Municipality has no control. He blames his local council — the local council is putting up the tax — and naturally the stage is reached where the local council has also to put up the tariffs because it, like any household, is subject to the same inflation rate as that household because of the commodities being purchased. Mr. Palser indicated that there should be a levelling out of tariffs, that the coastal town should pay the same as the Transvaal with its coal mines and cheaper production. I wonder if we of the Transvaal might suggest that there be a levelling out of fuel prices so that we could pay the same for our motor fuel as people in coastal towns. But I want to indicate that there is a case to be made out for a special tariff for local government for the simple reason that industry and every other user of electricity normally passes increased costs to the consumer and, when it is transferred to the consumer, the spread is wider and people absorb such increases more easily as they are hidden increases — one does not know about it. There is of course such a thing as hidden GST when people in business pass on any increasing taxation that they have to suffer, be it rates or what ever it may be, to the consumer. So the load and the burden is spread over a much wider field and I believe there is a case to be made out for a special municipal tariff and I would urge that your organisation have another look at it. Thank you.

### MR. K. G. ROBSON: EAST LONDON

Mr. President, I wonder if Mr. Palser is quite correct in his thought that ESCOM is moving towards uniform tariffs. Naturally my understanding is that they will move quite far along the road, but I believe that it is not towards a fully uniform tariff. ESCOM could, perhaps, give some indication of which of these thoughts is correct. The second point I would like to make, supporting Mr. Palser in our co-operation with ESCOM, is to ask the question of ESCOM as to whether or not they prefer the underfrequency load shedding system which seems to me, in some ways, more satisfactory provided everybody is treated on the same basis, rather than the voluntary load shedding. But it may be that ESCOM has very good reasons for changing this to a voluntary system and, if ESCOM could comment on that, it would be appreciated. Then the third question to ESCOM is whether their difficulties are such that it is not possible to correct time during night hours. One realises that they have got difficulties, but it does seem that it is most unsatisfactory that, in a country like SA, we are in a situation now that our national time system is inaccurate, creating a situation as in East London where in two weeks we lost nine minutes. It does seem to me that this is unsatisfactory. All of us are tending to say that this is a passing phase, but its difficult to understand why it is not possible to correct the time, if not on first night, then perhaps over two or three nights. Thank you.

### MR. E. WOHLBERG: ESCOM

Mr. President, of the questions that have been put here, one is the equalising of the rates. The board of trade commented on this, and was against it. I think Councillor Oberholzer mentioned the problem that exists in equalisation of energy rates. It cuts across a very big spectrum so there is a big problem in that matter. As far as load shedding is concerned ESCOM is working on a system (this was Mr. Robson's question), where we try to use various methods, in other words there is the voluntary load shedding, there is the load curtailment if we know that, during a given day we will not be able to meet our demand because of reserve capacity problems,

and then there is the further compulsory load shedding. Thus one tries to be a jump ahead and we are trying to introduce a system where we have three different ways of working.

This depends very much on the co-operation of consumers, but we hope we won't have to resort to this sort of thing on a large scale, but I think the way we are placed at the mo-

ment with reserve capacity we must face this problem. The third point deals with the question of time correction. Here again, with the reserve capacity problem that we have, to try and meet the demand of the next day one usually finds that, during the night, maintenance is being done which also has fallen behind so we have not got the capacity during the night to catch up, no matter how hard we try.

## REPORT OF THE SABS CO-ORDINATING COMMITTEE

1. Unless otherwise stated, this report covers the period 1978-09-01 to 1980-12-31.
2. The members of the Committee are Messrs. J. A. Loubser, J. K. von Ahlften and E. de C. Pretorius (Convener).
3. Meetings:
  - 3.1 The Committee, which was appointed on 1970-03-02, held seven meetings of which the President attended a few. A considerable number of matters was settled by telephone.
  - 3.2 In addition, the Committee, complemented by the President, (a) on 1979-05-23 had a long discussion with the Chief Inspector of Factories, Mr. A. A. Weich, on the legalization of the SABS Code of Practice for the Wiring of Premises and (b) on 1981-01-29 attended a meeting of major power cable users which had been convened by the SABS primarily in connection with mark fees for power cables. (The meeting was honoured by the presence of the Director General of the SABS, Mr. G. P. Verster).
  - 3.3 A few thought provoking items from the minutes of the meetings are given in the following:
    - 3.3.1 Concern was expressed that the contribution and/or opinion of AMEU representatives on SABS committees at times inevitably were inclined to be subjective and did not necessarily reflect the general view of the AMEU. After a long discussion it was concluded that it was virtually impossible to control or obviate such an eventuality. However, representatives by and large have a good sense of responsibility; moreover, they could be called to account at a Convention.
    - 3.3.2 At a meeting, which was also attended by the President, the Committee resolved to withdraw AMEU representation on some 30 SABS committees because the relevant projects have, in the opinion of the Committee, no bearing on the functions of electricity undertakings.  
(The projects in question are, inter alia, Accumulator batteries for motor vehicles, Electric toasters, Electric irons, Oven thermostats, Duct work for air-conditioning, etc.  
The Committee has already been criticised about the withdrawal from projects in connection with domestic electrical appliances. The convention is requested to express a view on this matter).
    - 3.3.4 The discussions with Mr. Weich led to a special meeting of the Executive Council of the AMEU on 1979-08-17 at which Mr. Weich was also present and, arising from this meeting, the Executive Council on 1979-11-09 resolved to inform Mr. Weich that, regardless of legal stumbling blocks, the AMEU was committed to the implementation of the Code of Practice as from 1st January 1980.

## VERSLAG VAN DIE SABS- KOÖRDINERENDEKOMITEE

1. Tensy anders vermeld, dek hierdie verslag die tydperk 1978-09-01 tot 1980-12-31.
2. Die Komitee bestaan uit mnr. J. A. Loubser, J. K. von Ahlften en E. de C. Pretorius (saamroeper).
3. Vergaderings:
  - 3.1 Die Komitee, wat op 1979-03-02 saamgestel is, het sewe keer vergader. Die President het enkele vergaderings bygewoon. Heelwat sake is telefonies afgehandel.
  - 3.2 Bykomend tot hierdie vergaderings het die Komitee — die President was ook teenwoordig — (a) op 1979-05-23 lang samesprekings gevoer met die Hoofinspekteur van Fabriek, mnr. A. A. Weich, oor die wettiging van die SABS se Gebruikskode vir die Bedrading vir Persele en (b) op 1981-01-29 'n vergadering bygewoon van belangrike gebruikers van kragkabels, wat deur die SABS belê is (en wat o.a. ook deur die Direkteur-generaal van die SABS, mnr. G. P. Verster, bygewoon is) in verband met merkgelde vir kragkabels.
  - 3.3 Enkele gedagteprikkelende items uit die notules van die vergaderings is die volgende:
    - 3.3.1 Daar is besorgdheid uitgespreek dat die bydrae en/of menings van VME0-verteenwoordigers op SABS-komitees uiteraard soms geneigd is tot subjektiwiteit en nie noodwendig dié van die VME0 in die algemeen weerspieël nie. Na 'n lang bespreking is tot die gevolgtrekking gekom dat dit feitlik onmoontlik is om so 'n toedrag van sake te beheer of te voorkom. Verteenwoordigers is egter almal verantwoordelike mense; boonop kan hulle deur Konvensie ter verantwoordelike groep word.
    - 3.3.2 Op 'n vergadering, wat ook deur die President bygewoon is, is besluit om VME0-verteenwoordiging op 'n stuk of 30 SABS-komitees te onttrek omdat die betrokke projekte, volgens die mening van die Komitee, nie verband hou met die funksies van elektrisistels-ondernemings nie.  
(Die betrokke projekte is o.a. Opgaarbatteery vir motorvoertuie, Elektriese broodroosters, Elektriese strykysters, Oondtermostate, Lugversorgingskanale e.d.m.  
Daar is reeds kritiek uitgespreek oor die onttrekking van projekte i.v.m. huishoudelike elektriese toestelle. Die Konvensie moet hom asb. oor hierdie aanbeentheid uitspreek).
    - 3.3.4 Die samesprekings met mnr. Weich het uitloopte op 'n spesiale vergadering van die Uitvoerende Raad op 1979-08-17 waarby mnr. Weich ook teenwoordig was, en voortspruitend uit hierdie vergadering het die Uitvoerende Raad op 1979-11-09 besluit om mnr. Weich mee te deel dat, ongeag wetlike struikelblokke, die VME0 hom verbind het aan die implementering van die Gebruikskode vanaf 1 Januarie 1980.

# Dis daardie finale merk van kwaliteit wat u produk nodig het om dit 'n marktreffer te maak.



Die finale afronding is herkenning.  
'n Onderskeidingsteken wat die  
deurslag gee by die keuse van wat om te  
koop.

Die SABS-merk van kwaliteit.  
Dit wys met 'n oogopslag dat u produk  
teen 'n veeleisende spesifikasie getoets is  
en dat 'n hoë standaard ononderbroke  
gehandhaaf word.

Die oomblik van verkoop, word die  
oomblik van oortuiging.

## SABS stel die standaard.

Rig navrae aan die Direkteur-generaal, SABS, Privaatsak X191, Pretoria 0001

KMP 3420/A

3.5.1 (a) At the meeting convened by the SABS in connection with mark fees for power cables, the Committee supported the SABS in its intention to raise the fees. Relatively speaking the increases would be insignificant: the biggest increase would be with regard to paper-insulated cable, viz. 0.9 c/km. These increases will inevitably be added to the price of cables.

(b) Mr. J. W. Smit, Director of the Electrical Engineering and Physics section of the SABS, who chaired the meeting, undertook to deal with this matter, in particular, and the mark scheme in general in further detail at the Convention.

3.5.2 At this meeting it was alleged (in a tabled document) that there was a considerable number of AMEU members, some of them very large undertakings, who did not insist on the SABS mark on power cables. I believe this is done unwittingly: in many cases enquiries for and the purchase of cables are entrusted to non-technical persons. An earnest appeal is made to AMEU members to insist on the SABS mark, not only on power cables, but on all other products for which an SABS specification exists.

3.5.3 It also came to light that a surprisingly large number of users labour under the delusion that when they purchase cables (and other products) from mark holders they will, with no further ado, be supplied with a product bearing the mark. For instance there is nothing to prevent a cable mark holder from manufacturing cables that do not bear the mark, and to only specify that a product shall comply with a SABS specification is no guarantee that this would be so unless the SABS issued a certificate to this effect.

3.5.4 Mr. Smit sounded the opinion of the meeting on a suggestion to bring the SABS specifications for power cables into line with IEC specifications. The vast majority of those present, including the Committee, vehemently opposed such a move because this would invariably lead to lowered requirements.

3.5.5 Mr. Smit also informed the meeting about steps being taken by the SABS to step up and streamline its control over quality assurance of manufacturers.

4.1 A good friend of the AMEU — at all times there was the heartiest co-operation between him and the AMEU — namely Mr. Felix Prins, who for many years served the SABS and during the latter years had been in charge of the power cable section, retired on pension. Mr. J. V. (Ian) Grant is his successor.

4.2 The former Director General of the SABS, Mr. R. F. J. Teichmann, has also retired on pension and has been succeeded by Mr. G. P. Verster.

#### 5. Progress report

During the period under review the following SABS committees on which the AMEU has representation, were active. Given in the table are the names of the AMEU representatives — (P/A means alternate) — and brief summaries of the activities undertaken.

(\*AMEU representation withdrawn; (+): reported; (a) Project no., (b) Titles (some condensed), (c) Representative(s), (d) Progress reports; some reports are based on information received directly from the SABS).

5.01 (a) \*711/5018 (c) A. H. L. Fortman.

(b) THE INSTALLATION OF (FM AND TV) AERIAL SYSTEMS.

(d) Revision approved by SABS Council on 1979-06-06.

5.02 (a) 721/5004 (c) J. K. von Ahlfen (+), P. J. Botes.

(b) TUNGSTEN FILAMENT GENERAL SERVICE ELECTRIC LAMPS.

(d) SABS 56-1961 has been amended to include lamps finished white internally and certain voltage rat-

3.5.1 (a) Op die vergadering insake merkgelde vir kragkabels het die Komitee die SABS gesteun in sy voorneme om gelde te verhoog. Relatief gesproke sal die verhogings gering wees: die grootste verhoging is t.o.v. papiergeïsoleerde kabel wat 0,9 c/km beloop. Hierdie verhogings sal noodwendig by die prys van kabels gevoeg word.

(b) Mnr. J. W. Smit, Direkteur van die SABS se afdeling Elektrotegniese Ingenieurswese en Fisika, wat voorsitter van die vergadering was, het onderneem om die Konvensie verder oor hierdie aangeleentheid in besonder en die merkakema oor die algemeen toe te lig.

3.5.2 Op hierdie vergadering is (in 'n dokument wat ter tafel gelê is) beweer dat daar heelwat VMEQ-lede is, sommige daarvan baie groot ondernemings, wat nie aandring op die SABS-merk op kragkabels nie. Ek glo nie dit word doelbewus gedoen nie: in baie gevalle word die aanvra van tenders vir en die aankoop van kabels in die hande van nie-tegniese mense oorgelaat. 'n Ernstige beroep word op VMEQ-lede gedoen om aan te dring op die SABS-merk, nie net t.o.v. kragkabels nie, maar alle produkte waarvoor daar 'n SABS-spesifikasie bestaan.

3.5.3 Dit het ook aan die lig gekom dat verbasend baie verbruikers onder die waa verkeer dat wanneer hulle kabels (en ander produkte) van merkhouers koop hulle sonder meer 'n produk met die merk sal kry. Daar is niks wat byvoorbeeld 'n kabelmerkhouer verbied om kabels te vervaardig wat nie die merk dra nie. En om net te spesifiseer dat 'n produk aan 'n toepasslike SABS-spesifikasie moet voldoen is geen waarborg dat dit wel die geval is nie tensy 'n sertifikaat tot die effek deur die SABS uitgereik is.

3.5.4 Mnr. Smit het die vergadering gepols oor die gedagte om die SABS-kabelspesifikasies op een lyn met dié van die IEC te bring. Die oorgrote meerderheid van die vergadering, insluitend die Komitee, was heftig daarteen gekant omdat dit onteenseglik sou lei tot 'n verlaging van vereistes.

3.5.5 Mnr. Smit het die vergadering ook toegelig oor die SABS se stappe om sy beheer oor kwaliteitsverkeering van vervaardigers op te knap.

4.1 'n Goëie vriend van die VMEQ — daar was altyd die hartlikste samewerking met hom — nl. mnr. Felix Prins, wat baie jare in diens van die SABS was en in later jare belas was met kragkabels, het met pensioen uit die SABS se diens getree. Mnr. J. V. (Ian) Grant het hom opgevolg.

4.2 Ook die vorige Direkteur-generaal van die SABS, mnr. R. F. J. Teichmann, het met pensioen afgetree en is opgevolg deur mnr. G. P. Verster.

#### 5. Vorderingsverslag

Gedurende die onderhawige tydperk was die volgende SABS-komitees waarop die VMEQ verteenwoordig is, aktief. In die tabel word ook die VMEQ-verteenwoordigers aangedui — (P/A beteken plaasvervanger) — en 'n kort opsomming van die werksaamhede gegee.

(\*VMEQ-verteenwoordiging onttrek; (+): verslag gegee; (a) Projeknommer, (b) Onderwerp (sommige verkort), (c) Verteenwoordiger(s), (d) Vorderingsverslag; sommige verslae is gebaseer op inligting wat direk van die SABS ontvang is).

5.01 (a) \*711/5018 (c) A. H. L. Fortmann.

(b) DIE INSTALLASIE VAN (FM- EN TV-) ANTENNASTELSELS.

(d) Hersiening deur SABS-raad goedgekeur op 1979-06-06.

5.02 (a) 721/5004 (c) J. K. von Ahlfen (+), P. J. Botes.

(b) ELEKTRIESE LAMPE MET WOLFRAMGLOEIDRAAD VIR ALGEMENE GEBRUIK.

(d) SABS 56-1961 is gewysig om lampe in te sluit wat binne wit afgewerk is en sekere spannings-

ings have been deleted from the specification. The requirement has been amended to require the nominal lumen output to be marked on the lamp instead of stating single coil or coiled coil filaments are used.

- 5.03 (a) 721/5005 (c) J. K. von Ahlfen (+).  
(b) BALLASTS FOR LOW PRESSURE SODIUM VAPOUR AND HIGH INTENSITY DISCHARGE LAMPS.  
(d) Amendment No. 2: SABS 1266-1979. The specification has been amended to include requirements for enamelled conductors and terminals and to extend the requirements for limitation of heating.
- 5.04 (a) (i) 721/5006; (ii) 721/5016; (iii) 721/5022 (c) A. J. v. d. Berg (+), R. Yates (P/A) (+).  
(b) (i) INTERIOR LUMINAIRES FOR DISCHARGE LAMPS; (ii) STREET LIGHTING LUMINAIRES; (iii) FLOODLIGHTING LUMINAIRES.  
(d) Specifications approved on 1980-02-27.  
(These three projects have been combined).
- 5.05 (a) 721/5010 (c) P. J. Botes (+), C. F. Coetzee (P/A).  
(b) BALLASTS FOR FLUORESCENT LAMPS.  
(d) Amended (ballast output and limitation of heating).
- 5.06 (a) 721/5012 (c) A. J. v. d. Berg (+), R. Yates (P/A).  
(b) CAPACITORS FOR FLUORESCENT LUMINAIRES.  
(d) Specification approved on 1979-06-06.
- 5.07 (a) 721/5015 (SABS 1119-1976) (c) R. Yates (+), D. Opperman (P/A).  
(b) INTERIOR LUMINAIRES FOR FLUORESCENT LAMPS.  
(d) Amendment no. 1 (capacitors, conductors) approved in February 1980; amendment no. 2 (additional constructional requirements) still receiving attention.
- 5.08 (a) 751/5001 (SABS 0142-1978) (c) Main committee/Hoofkomitee: J. A. Loubser (+), E. de C. Pretorius (+), J. K. von Ahlfen, P. J. Botes; WG3: J. A. Loubser (+); WG4: J. J. Boshoff (+), C. Hecker.  
(b) CODE OF PRACTICE FOR THE WIRING OF PREMISES.  
(d) A two-day meeting was held in April 1980 to discuss comments on a number of proposed amendments to the Code. A large number of amendments were adopted and were, together with the Wiremen's Guide, to be submitted to the SABS Council and were expected to be published during the first half of 1981. WG3 (international regulations) still continues its work though problems are being experienced as regards secretarial services. WG4 also held a number of meetings.
- 5.09 (a) 751/5006 (c) J. A. Loubser (+), P. J. Botes (P/A).  
(b) TWO-POLE AND EARTHING-PIN PLUGS AND SOCKET OUTLETS.  
(d) Completed. SABS 164-1980.
- 5.10 (a) 751/5007 (c) C. F. Coetzee, R. E. du Toit (P/A).  
(b) TERMINAL BLOCKS FOR ELECTRICAL PURPOSES.  
(d) Committee stage.

waardes is uit die spesifikasie geskrap. Die werkverleste is gewysig om te verlei dat die nominale lumenlewering op die lamp in plaas van 'n enkelspiraal of dubbelspiraal gloeidraad gebruik word.

- 5.03 (a) 721/5005 (c) J. K. von Ahlfen (+).  
(b) BALLASTE VIR LAEDRUKNATHRIUMDAMP-ONTLADINGSLAMPE EN VIR HOE-INTENSITEITSONTLADINGSLAMPE.  
(d) Wysiging No. 2: SABS 1266-1979. Die spesifikasie is gewysig deur die insluiting van vereistes vir getimiseerde geleiers en aansluiters en deur die uitbreiding van die vereistes vir beperking van verhitting.
- 5.04 (a) (i) 721/5006; (ii) 721/5016; (iii) 721/5022 (c) A. J. v. d. Berg (+), R. Yates (P/A) (+).  
(b) (i) BINNEARMATURE VIR ONTLADINGSLAMPE; (ii) STRAATVERLICHTINGSARMATURE; (iii) SPIREILGARMATURE.  
(d) Spesifikasie goedgekeur op 1980-02-27.  
(Hierdie drie projekte is gekombineer).
- 5.05 (a) 721/5010 (c) P. J. Botes (+), C. F. Coetzee (P/A).  
(b) BALLASTE VIR FLUORESEERLAMPE.  
(d) Gewysig (ballalewering, beperking van verhitting).
- 5.06 (a) 721/5012 (c) A. J. v. d. Berg (+), R. Yates (P/A).  
(b) KAPASITORS VIR FLUORESEERARMATURE.  
(d) Spesifikasie goedgekeur op 1979-06-06.
- 5.07 (a) 721/5015 (SABS 1119-1976) (c) R. Yates (+), D. Opperman (P/A).  
(b) BINNEARMATURE VIR FLUORESEERLAMPE.  
(d) Wysiging nr. 1 (kapasitors, geleiers) goedgekeur in Februarie 1980; wysiging nr. 2 (bykomstig konstruksieverleste) kry nog aandag.
- 5.08 (a) 751/5001 (SABS 0142-1978) (c) Main committee/Hoofkomitee: J. A. Loubser (+), E. de C. Pretorius (+), J. K. von Ahlfen, P. J. Botes; WG3: J. A. Loubser (+); WG4: J. J. Boshoff (+), C. Hecker.  
(b) GEBRUIKSKODE VIR DIE BEDRADING VAN PERSELE.  
(d) In April 1980 is 'n tweedaagse vergadering gehou om kommentaar oor en 'n menigte voorgestelde wysigings van die Kode te oorweeg. 'n Groot getal wysigings is aanvaar en sou, saam met die Handleiding vir Draadwerkers, aan die SABS-raad voorgelê word; word verwag om gedurende die eerste helfte van 1981 gepubliseer te word. WG3 (internasionale regulasies) se werk gaan steeds voort maar ondervind probleme met sekretariaat dienste. WG 4 het ook 'n aantal vergaderings gehou.
- 5.09 (a) 751/5006 (c) J. A. Loubser (+), P. J. Botes (P/A).  
(b) TWE-POOL- EN AARDINGSPENKONTAKPROPPE EN SOKKUITGANGE.  
(d) Volttool. SABS 164-1980.
- 5.10 (a) 751/5007 (c) C. F. Coetzee, R. E. du Toit (P/A).  
(b) AANSLUITERBLOKKE VIR ELEKTRIESE DOELEINDES.  
(d) Komiteestadium.

- 5.11 (a) 751/5008 (SABS 1197: Part/Deel 1-1978) (c) J. J. Boshoff (+), M.E.O. Bick (P/A).  
 (b) METALLIC WIREWAYS — WALLS AND CEILINGS.  
 (d) Amendment no. 1 approved on 1980-11-05.
- 5.12 (a) 751/5009 (c) J. A. Loubser (+), P. J. Botes (P/A).  
 (b) PLUGS, SOCKET OUTLETS, COUPLERS — NON-DOMESTIC.  
 (d) Completed. SABS 1239-1979.
- 5.13 (a) 751/5010 (c) J. A. Loubser (+).  
 (b) WALL OUTLET BOXES FOR ELECTRICAL ACCESSORIES (REVISION): PART I: STANDARD BOXES.  
 (d) Completed. SABS 1085: Part I — 1980.
- 5.14 (a) 751/5012 (c) J. A. Loubser (+).  
 (b) COVER PLATES FOR WALL OUTLET BOXES — AMENDMENT NO. 1.  
 (d) Amended 1980-11-05.
- 5.15 (a) (i) 751/5015. (ii) 751/5016. (c) J. A. Loubser (+).  
 (b) ELECTRICAL DISTRIBUTION BOARDS: (i) Part II: Surface type for mounting on indoor walls; (ii) Part III: Type for small installations.  
 (d) Completed: SABS 1180: (i) Part II: 1980; (ii) Part III: 1980.
- 5.16 (a) 751/5017 (c) J. J. Boshoff (+).  
 (b) METALLIC WIREWAYS (FLOORS).  
 (d) Two committee meetings. On 1980-06-17 draft was circulated for comments: closing date 1980-07-17.
- 5.17 (a) 751/5018 (c) J. J. Boshoff (+).  
 (b) NON-METALLIC WIREWAYS (WALLS OR CEILINGS).  
 (d) One committee meeting.
- 5.18 (a) 761/5002 (c) G. C. Theron, M. P. P. Clarke (+), L. D. M. de Wet (P/A).  
 (b) AMENDMENT NO. 3 OF SABS 97-1970: PAPER-INSULATED CABLES.  
 (d) Finalized — will possibly be published by mid 1981.
- 5.19 (a) \*761/5003 (c) A. J. v. d. Berg, P. J. Botes (P/A).  
 (b) HEAT RESISTING CABLES FOR THE INTERNAL WIRING OF APPLIANCES.  
 (d) Amended 1979-06-06.
- 5.20 (a) 761/5006 (c) P. J. Botes, A. H. L. Fortman (+), E. de C. Pretorius, M. W. Odendaal (P/A).  
 (b) CROSSED-LINKED POLYETHYLENE (XLPE) INSULATED ELECTRIC CABLES.  
 (d) This project covers cables in the 3,8/6,6 kV to 19/33 kV range. As local authorities constitute one of the largest, if not the largest, users of cables in the RSA, this project is of vital importance to the AMEU. The first meeting was held on 1978-01-18 and subsequently another eight were held, the last on 27 and 28 November 1980. The draft will be submitted to the SABS Council and the specification, it is hoped, will be published in May 1981.  
 At all times the AMEU representatives took a firm stand, particularly when it came to the watering down of requirements and thus achieved their aims.
- 5.11 (a) 751/5008 (SABS 1197: Part/Deel 1-1978) (c) J. J. Boshoff (+), M.E.O. Bick (P/A).  
 (b) METAALBEDRADINGSKANALE — MURE EN PLAFONNE.  
 (d) Wysiging nr. 1 goedgekeur 1980-11-05.
- 5.12 (a) 751/5009 (c) J. A. Loubser (+), P. J. Botes (P/A).  
 (b) PROPPE, KONTAKSOKKE, KOPPELSTUKKE — NIE-HUISHOUELIK.  
 (d) Voltooi. SABS 1239-1979.
- 5.13 (a) 751/5010 (c) J. A. Loubser (+).  
 (b) MUURUITGANGKASTE VIR ELEKTRIESE BY-BEHORE (HERSIENING): DEEL I: STANDAARD KASTE.  
 (d) Voltooi. SABS 1085: Deel I — 1980.
- 5.14 (a) 751/5012 (c) J. A. Loubser (+).  
 (b) DEKPLATE VIR MUURUITGANGKASTE — WYSIGING NR. 1.  
 (d) Gewysig 1980-11-05.
- 5.15 (a) (i) 751/5015. (ii) 751/5016. (c) J. A. Loubser (+).  
 (b) ELEKTRIESE VERDEELBORDE: (i) Deel II: Opperlakte tipe vir montering teen binnemure. (ii) Deel III: Tipe vir klein installasies.  
 (d) Afgehandel: SABS 1180: (i) Deel II: 1980; (ii) Deel III: 1980.
- 5.16 (a) 751/5017 (c) J. J. Boshoff (+).  
 (b) METAALBEDRADINGSKANALE (VLOERE).  
 (d) Twee komiteevergaderings. Op 1980-06-17 is konsep gesirkuleer vir kommentaar: sluitingsdatum 1980-07-17.
- 5.17 (a) 751/5018 (c) J. J. Boshoff (+).  
 (b) NIE-METAALBEDRADINGSKANALE (MURE OF PLAFONNE).  
 (d) Een komiteevergadering.
- 5.18 (a) 761/5002 (c) G. C. Theron, M. P. P. Clarke (+), L. D. M. de Wet (P/A).  
 (b) WYSIGING NR. 3 VAN SABS 97-1970: KABELS MET PAPIERISOLERING.  
 (d) Gefinaliseer — sal waarskynlik teen middel 1981 gepubliseer word.
- 5.19 (a) \*761/5003 (c) A. J. v. d. Berg, P. J. Botes (P/A).  
 (b) HITTEBESTANDE KABELS VIR DIE INTERNE BEDRADING VAN ELEKTRIESE TOESTELLE.  
 (d) Gewysig 1979-06-06.
- 5.20 (a) 761/5006 (c) P. J. Botes, A. H. L. Fortman (+), E. de C. Pretorius, M. W. Odendaal (P/A).  
 (b) ELEKTRIESE KABELS MET GEVOLKANISEERDE POLIETYLEN- (XLPE) ISOLERING.  
 (d) Hierdie projek dek kables in die reeks 3,8/6,6 kV tot 19/33 kV. Aangesien plaaslike owerhede moontlik die grootste gebruikers van kables in die RSA is, het die VMEO inderdaad baie belang by hierdie projek. Die eerste komiteevergadering is op 1978-01-18 gehou, en daarna nog agt; die jongste vergadering is op 27 en 28 November 1980 gehou. Die konsep sal aan die SABS-raad voorgelê en die spesifikasie hopelik in Mei 1981 gepubliseer word.  
 Ten alle tye het die VMEO-vertegenwoordigers 'n sterk standpunt ingeneem, veral waar daar sprake was van verwatering van vereistes, en wel met groot sukses.

- 5.21 (a) (i) 761/5008 (ii) 761/5011 (iii) 761/5013 (c) D. Briers (+), J. A. Loubser (P/A).  
 (b) CONDUCTORS FOR OVERHEAD ELECTRICAL TRANSMISSION LINES (SABS 182).  
 (i) Part 1: Copper wires and stranded copper conductors.  
 Part 2: Stranded aluminium conductors.  
 Part 3: Aluminium conductors, steel reinforced.  
 (ii) Part 4: Copper-clad steel wire: Telecommunication.  
 (iii) Part 5: Zinc-coated steel wires for conductors and stays.  
 (d) Parts 2 and 3: Amendment of conductor sizes published 1980.  
 Parts 4 and 5: Completed and published in 1979.
- 5.22 (a) 761/5012 (c) P. J. Botes (+), C. F. Coetzee (P/A).  
 (b) THE SELECTION, HANDLING AND INSTALLATION OF ELECTRIC POWER CABLES UP TO AND INCLUDING 22 kV RATING.  
 (d) Comments invited 1980-08-15 — no further progress.
- 5.23 (a) 761/5021 (c) P. J. Botes (+), J. K. von Ahlfen (P/A).  
 (b) COMBINED NEUTRAL/EARTH: 600/1000-V CABLES.  
 (d) Prepared and submitted to SABS Council and approved after 1979-07-02.
- 5.24 (a) 771/5004 (c) F. J. v. d. Merwe, A. H. L. Fortman (P/A).  
 (b) MOULDED CASE CIRCUIT BREAKERS.  
 (d) Being amended.
- 5.25 (a) \*771/5010 (c) P. J. Botes, C. F. Coetzee (P/A).  
 (b) BUSBAR TRUNKING.  
 (d) Revision approved 1980-08-20.
- 5.26 (a) 771/5014 & 5015 (c) F. J. v. d. Merwe (+), J. A. Loubser, G. C. Theron.  
 (b) CORE BALANCE EARTH LEAKAGE PROTECTION UNITS.  
 (d) Part II of the document for portable units has been circulated for comment with 1980-09-28 as closing date.  
 Part I of the document for fixed installations has been circulated for comment with 1981-01-02 as closing date.
- 5.27 (a) 781/5001 (c) A. J. v. d. Berg (+).  
 (b) FIXED ELECTRIC STORAGE HEATERS.  
 (b) Being amended.
- 5.28 (a) 781/5015 (c) G. C. Theron (+), M. E. O. Bich (P/A).  
 (b) COMPULSORY SAFETY SPECIFICATIONS FOR ELECTRICAL APPLIANCES.  
 (d) One meeting: April 1980. Resolved: (i) That the present SABS mark scheme be not modified or extended to cover a safety mark. (ii) That a levy of 5,25 c per article be applied to all appliances, imported or locally manufactured, covered by Schedule 13 to defray the cost of administering the safety requirements.
- 5.21 (a) (i) 761/5008 (ii) 761/5011 (iii) 761/5013 (c) D. Briers (+), J. A. Loubser (P/A).  
 (b) GELEIERS VIR BOGRONDSE ELEKTRIESE TRANSMISSIELYNE (SABS 182).  
 (i) Deel 1: Koperdrade en koperstringgeleiers.  
 Deel 2: Aluminiumstringgeleiers.  
 Deel 3: Aluminiumgeleiers, met staal versterk.  
 (ii) Deel 4: Koperomhulde staalraad: Telekommunikasie.  
 (iii) Deel 5: Versinkte staalraad vir geleiers en ankers.  
 (d) Dele 2 en 3: Wysiging t.o.v. geleiergroottes gepubliseer 1980.  
 Dele 4 en 5: Voltooi en in 1979 gepubliseer.
- 5.22 (a) 761/5012 (c) P. J. Botes (+), C. F. Coetzee (P/A).  
 (b) DIE KIES, HANTERING EN INSTALLERING VAN ELEKTRIESE KABELS TOT EN MET 22-kV-ONTWERPSPANNING.  
 (d) Kommentaar aangevra 1980-08-15 — geen verdere ontwikkeling.
- 5.23 (a) 761/5021 (c) P. J. Botes (+), J. K. von Ahlfen (P/A).  
 (b) GEKOMBINEERDE NUL/AARDGELEIER: 600/1000-V-KABELS.  
 (d) Opgestel en aan SABS-raad voorgelê en goedgekeur na 1979-07-02.
- 5.24 (a) 771/5004 (c) F. J. v. d. Merwe, A. H. L. Fortman (P/A).  
 (b) GEVORMDEHULSSTROOMBREKERS.  
 (d) Word gewysig.
- 5.25 (a) \*771/5010 (c) P. J. Botes, C. F. Coetzee (P/A).  
 (b) GELEISTAMKANALE.  
 (d) Hersiening goedgekeur 1980-08-20.
- 5.26 (a) 771/5014 & 5015 (c) F. J. v. d. Merwe (+), J. A. Loubser, G. C. Theron.  
 (b) AARDLEKBEVEILIGINGSENHEDE VAN DIE STROOMBALANSTIPE.  
 (d) Deel II van die dokument vir draagbare eenhede is gesirkuleer vir kommentaar met sluitingsdatum 1980-09-28.  
 Deel I van die dokument vir vaste installasies is gesirkuleer vir kommentaar met sluitingsdatum 1981-01-02.
- 5.27 (a) 781/5001 (c) A. J. v. d. Berg (+).  
 (b) VASTE ELEKTRIESE OPGAARVERWARMERS.  
 (d) Word gewysig.
- 5.28 (a) 781/5015 (c) G. C. Theron (+), M. E. O. Bich (P/A).  
 (b) VERPLIGTE VEILIGHEIDSPESIFIKASIES VIR ELEKTRIESE TOERUSTING.  
 (d) Een vergadering: April 1980. Besluit: (i) Dat daar nie verander word aan of uitgebrei word op die huidige SABS-merkema nie. (ii) Dat 'n heffing van 5,25 c per artikel gehef word op alle apparat gedek deur Skedule 13, wat ingevoer of plaaslik vervaardig word om uitgewe ten opsigte van die toepassing van die veiligheidsvereistes te bestry.

According to the SABS the first publication appeared in the Government Gazette on 1980-08-29.

With regard to IEC: TC 61 (Safety of household and similar electrical appliances) Mr. Theron reports as follows:

The work is done by correspondence and covers all possible appliances from saunas to tooth-brushes. Due to the international set-up, finality is sometimes long delayed.

Approved for publication: 30 projects or amendments.

Awaiting final approval: 15 projects or amendments.

Under consideration: 66 projects or amendments. It was noticeable that the East-European countries took a greater interest in the workings of TC 61 during the past year. Italy requested that electrical farming equipment be given attention.

5.29 (a) \*781/5038 (c) J. H. Davies (+).

(b) ELECTRIC STOVES AND SIMILAR APPLIANCES: REVISION OF SABS 154-1955.

(d) Final specification prepared for SABS Council.

5.30 (a) 781/5042 (c) J. J. Boshoff (+), A. J. v. d. Berg (P/A) (+).

(b) INSTANT WATER HEATERS.

(d) Project not yet completed. Second committee meeting held on 1980-07-01. Draft being prepared for comment.

5.31 (a) 791/5001 (c) M. P. P. Clarke (+).

(b) THE PROTECTION OF STRUCTURES AGAINST LIGHTNING.

(d) The committee met in November 1980 and made good progress in finalizing details of a draft code. It is anticipated that agreement will be reached on various outstanding items at a meeting scheduled in 1981, whereafter the proposals will be processed by the SABS for final approval and publication.

5.32 (a) 791/5015 (c) I. F. Boyack (+), E. H. Scholes, D. H. Fraser.

(b) INSULATION CO-ORDINATION.

(d) Draft document will be circulated as soon as circumstances permit.

5.33 (a) 791/5017 (c) I. F. Boyack (+), V. A. Raynal (P/A), F. L. Knobel (P/A).

(b) DISTRIBUTION TRANSFORMERS.

(d) SABS 780-1979 published. Amendment no. 1 (minor modifications) submitted to SABS Council.

5.34 (a) 791/5025 (c) E. H. Scholes, H. D. O. von Oppel (P/A) (+).

(b) OVERHEAD POWER LINES.

(d) Three meetings were held to consider amendments to the Code of Practice for Overhead Power Lines.

A sub-committee, on which 11 AMEU corresponding representatives from the various branches serve, was appointed to consider proposed amendments to regulations C.63 to C.71 of the Factories Act. Several meetings were held with the Chief Inspector of Factories and representatives of other government departments at which the proposed amendments were agreed upon; these will in due course be incorporated in the revised regulations of the Act.

Volgens die SABS het die eerste publikasie in die Staatskoerant van 1980-08-29 verskyn.

T.o.v. IEK: TK 61 (Veiligheid van huishoudelike en verwante elektriese toerusting) doen mnr. Theron soos volg verslag:

Die werk word per pos gedoen en behels alle denkbare apparate vanaf saunas tot tandeborsels. Uit die aard van die saak word finaliteit soms lank vertraag.

Goedgekeur vir publikasie: 30 projekte of wysigings.

Wagtinge op finale goedkeuring: 15 projekte of wysigings.

Onder oorweging: 66 projekte of wysigings. Die groter deelname deur die Oos-Europese lande aan die werksaamhede van TK 61 die afgelope jaar was heel opvallend. Italië het voorgestel dat elektriese boerderytoerusting aandag moet kry.

5.29 (a) \*781/5038 (c) J. H. Davies (+).

(b) ELEKTRIESE STOWE EN SOORTGELYKE TOESTELLE: HERSIENING VAN SABS 154-1955.

(d) Finale spesifikasie word voorberei vir die SABS-raad.

5.30 (a) 781/5042 (c) J. J. Boshoff (+), A. J. v. d. Berg (P/A) (+).

(b) KITSWATERVERWARMERS.

(d) Projek nog nie afgehandel nie. Tweede komitee-vergadering gehou 1980-07-01. Konsep vir kommentaar word voorberei.

5.31 (a) 791/5001 (c) M. P. P. Clarke (+).

(b) DIE BEVEILIGING VAN STRUKTURE TEEN WEERLIG.

(d) Die komitee het gedurende November 1980 vergader en daar is goeie vordering gemaak met die finalisering van besonderhede vir 'n konsepkode. Dit word voorsien dat daar oor verskeie uitstaande items eensgesindheid bereik sal word gedurende 'n vergadering wat vroeg in 1981 gehou staan te word, waarna die voorstelle deur die SABS werk sal word vir finale goedkeuring en publikasie daarvan.

5.32 (a) 791/5015 (c) I. F. Boyack (+), E. H. Scholes, D. H. Fraser.

(b) ISOLASIE-KOÖRDINERING.

(d) Konsep sal gesirkuleer word sodra moontlik.

5.33 (a) 791/5017 (c) I. F. Boyack (+), V. A. Raynal (P/A), F. L. Knobel (P/A).

(b) VERSPREIDINGSTRANSFORMATORS.

(d) SABS 780-1979 is gepubliseer. Wysiging nr. 1 (kleinere wysigings) aan SABS-raad voorgelê.

5.34 (a) 791/5025 (c) E. H. Scholes, H. D. O. von Oppel (P/A) (+).

(b) BOGRONDSE KRAGLYNE.

(d) Drie vergaderings is gehou om wysigings van die Gebruikskode vir oorgondse Kraglyne te oorweeg.

'n Subkomitee, bestaande uit o.a. 11 korresponderende VMEO-vertegenwoordigers uit die verskeie takke, is benoem om voorgestelde wysigings van regulasies C.63 tot C.71 van die Fabriekswet te oorweeg. Verskeie vergaderings is met die Hoof-inspekteur van Fabriek en ander staatsdepartemente gehou waarop op die voorgestelde wysigings ooreengekom is; hulle sal binnekort in die hersiene regulasies van die Wet opgeneem word.



- 5.35 (a) 791/5029 (c) G. H. Dawes, P. J. Botes (P/A).  
(b) EARTHING.  
(d) Draft being prepared for comment.
- 5.36 (a) 791/5030 (c) G. H. Dawes, P. J. Botes (P/A).  
(b) HIGH VOLTAGE SYSTEM EARTHING.  
(d) Awaiting findings of workshops on neutral earthing.
- 5.37 (a) 851/5085 (c) J. J. Boshoff (+).  
(b) PLAIN-END METALLIC CONDUIT AND FITTINGS FOR ELECTRICAL WIRING — SABS 1007-1973.  
(d) Comments on minor amendments were invited by letter dated 1980-08-28.
6. The disposal of the following projects are, in my opinion, of material interest to the AMEU — (item no. in brackets): 721/5016 (5.04 (ii)), 751/5001 (5.08), 761/5006 (5.20).
- 7.1 On behalf of my committee and myself I wish to thank all those AMEU representatives who, invariably under difficult circumstances and pressure of work, studied the relevant SABS documents and attended the committee meetings. Certain representatives had to travel long distances to attend meetings. Thank you for your contributions.
- 7.2 A special word of appreciation is directed to Mr. G. C. Theron (honorary member) who has signified his desire to be relieved from AMEU/SABS activities. For many years he provided the liaison between the AMEU and the SABS and even after having retired on pension he was willing to represent the AMEU on SABS committees.
- 7.3 I also wish to thank those city and town councils in whose employ these representatives are, for the opportunities afforded to their employees to carry out this work, which is of national interest. I believe that this is a matter of casting one's bread on the waters.
8. Due to the situation of the SABS headquarters and the attendant travelling problem, AMEU representatives are, almost without exception, drawn from the Highveld Branch. I would, however, very much like to see more representatives being drawn from other branches and will welcome practical suggestions from the Convention in this regard.
9. I wish to thank all the SABS personnel concerned for their hearty co-operation, advice and assistance. I do not wish to tread on any one's toes but must single out Mr. J. W. Smit, the Director of the Electrical Engineering and Physics Department: we owe the strong ties which exists between the AMEU and SABS mainly to him.
10. We, the AMEU, must regard the SABS as one of our most loyal and strongest allies in our pursuit of offering our electricity consumers nothing less than the best. However, the SABS is virtually powerless if we do not co-operate by being loyal (e.g. mark-conscious) ourselves.
- 5.35 (a) 791/5029 (c) G. H. Dawes, P. J. Botes (P/A).  
(b) AARDING.  
(d) Konsep vir kommentaar voorberei.
- 5.36 (a) 791/5030 (c) G. H. Dawes, P. J. Botes (P/A).  
(b) HOËSPANNINGSTELSELAARDING.  
(d) Wag op uitslae van werkwinkels op aarding van nulgeleier.
- 5.37 (a) 851/5085 (c) J. J. Boshoff (+).  
(b) GLADDE-END METAALLEIPIYPE EN TOEBEHORE VIR ELEKTRIESE BEDRADING — SABS 1007-1973.  
(d) Kommentaar op klein voorgestelde wysigings is op 1980-08-28 per brief aangevra.
6. Myns insiens is die ahandeling van die volgende projekte van wesenlike belang vir die VME0 — (itemnr. in hakies): 721/5016 (5.04 (ii)), 751/500 (5.08), 761/5006 (5.20).
- 7.1 Namens myself en my komitee wil ek al die VME0-verteenwoordigers bedank wat, meestal onder baie moeilike omstandighede en te midde van drukke werksaamhede, die betrokke SABS-stukke bestudeer en komiteevergaderings bygewoon het; dankie vir u bydraes. Sommige verteenwoordigers moes lang afstande aflê om vergaderings by te woon.
- 7.2 'n Spesiale woord van waardering word gerig tot mnr. G. C. Theron (ere-lid) wat te kenne gegee het dat hy nou, wat SABS-werk betref, wil uitspan. Hy was baie jare lank die VME0 se skakel met die SABS en selfs nadat hy met pensioen afgetree het, was hy gewillig om die VME0 op SABS-komitees te verteenwoordig.
- 7.3 Ek wil ook die stadsrade in wie se diens hierdie verteenwoordigers is, bedank vir die geleentheid wat hulle hulle werknemers bied om hierdie werk, wat van nasionale belang is, te verrig: ek glo dit is 'n geval van jou brood op die water werp.
8. Weens die ligging van die SABS se setel en die gevolglike afstandprobleem word VME0-verteenwoordigers feitlik sonder uitsondering uit die Hoëveldtak benoem. Ek sou egtër graag wou sien dat daar heelwat meer verteenwoordigers uit ander takke aangewys word en sal praktiese voorstelle in dié verband uit die Konvensie verwelkom.
9. Ek wil al die betrokke personeel van die SABS bedank vir hulle hartlike samewerking, advies en hulp. Ek wil op niemand se tone trap nie maar wil tog mnr. J. W. Smit, Direkteur van die Afdeling Elektrotegniese Ingenieurswese en Fisika, in hierdie verband spesiaal vermeld: die sterk band wat daar tussen die VME0 en die SABS bestaan, is hoofsaaklik aan hom te danke.
10. Ons, die VME0, moet die SABS beskou as een van ons getrouste en sterkste bondgenote in ons strewing om net die beste aan ons elektrisiteitsverbruikers te bied. Maar die SABS se hande is afgekap as ons nie saamwerk deur nie self lojaal (o.a. merk-bewus) te wees nie.

E. DE C. PRETORIUS (Convener)

E. DE C. PRETORIUS (Samereger)



E. de C. Pretorius

## MR. E. DE C. PRETORIUS, POTCHEFSTROOM

Mr. President, we are honoured by the presence at the Convention, and particularly at the present time, of the Deputy Director-General of the Bureau of Standards, Mr. Pat Middlecote.

The Cape Eastern Branch inquired about the progress that has been made in the adoption of a standard voltage for SA, presumably the new standard voltage of the IEC, which is 230/400 volts. As this matter will also be raised under Item 17 or 18 of the Reports Agenda, I suggest that it be discussed at that stage.

Meneer Bokkie Boshoff van Vanderbijlpark het versoek om 'n probleem te stel onder item 5.11 van die verslag.

Meneer die President, daar is twee sake waaroor die Konvensie hom asseblief moet uitspreek of leiding moet gee, naamlik dit wat aangeroei word in items 3.3.2 en 8 van die verslag. Dié van u wat die verslag gelees het, sal weet waarna ek verwys.

Mr. Smit het onderneem om u verder in te lig oor item 3.5.1. Dit gaan oor merkeide. Ek dink net dat daar 'n klein foutjie ingesluit het in my verslag. Daar word 'n bedrag genoem van 0,9c per km; dit moet wees 0,9c per meter.

With reference to item 5.28, I wish to direct your attention to Government Gazette no. 7464 of 13 March 1981, in which a compulsory standard specification for the safety of electrical appliances (quite a formidable document) has been promulgated with effect from March 13, 1982.

## MR. J. W. SMIT: SABS

Mr. President, I owe some gratitude to Mr. Pretorius and his Committee for all their help and the support they gave us in our work over the past years. I think the report itself clarifies this very clearly for, as you will see, they have taken part in activities of 37 of our active committees. We can always rely on the AMEU to do their bit for us and we really do appreciate it. Mr. Pretorius has asked me to comment on the meeting which he detailed in his report and which was attended by representatives of a number of large consumers including Esacom, the AMEU, the SA Railways, the Department of Community Development etc. Now this meeting was held because last year we started negotiating with the Cable Industry to increase the SABS mark fee — I see them looking very critically at me.

We asked for a very substantial increase in the fee because we found that our income was falling short of our expenditure in administering the scheme. The Cable Manufacturers were very understanding when we put our care to them — our costs and so on — but they became less understanding when we asked them for an increase. One of the reasons they used was that the support for mark bearing cable was not sufficient to warrant an increase. There may be something in that Mr. Chairman, but we decided to hold this meeting with the main consumers, to see if we could not generate support for this mark scheme. I must say I think this was a great success. Two very important decisions were made at the meeting. The one was that the consumers were prepared to support the bureau in their request for an increase in the mark fee and the other was that they pledged support for the mark scheme on cables and also on other commodities, and I may say that since that meeting we have seen some stirrings in the junior personnel in some of these organisations, because they came to us and asked how we set up about insuring that we do get mark bearing cable.

It is our intention to do this more often because it served quite a useful purpose, and I would ask delegates at this Convention please to support us. We cannot survive without support. A very interesting point arose at this meeting, and this was that there was a general belief that if the consumer buys from a manufacturer having the mark, he automatically gets mark bearing products. This is, of course, not so and here I want to quote a case which Mr. Yates of the Johannesburg Municipality brought to my attention. He said that on a certain occasion he was offered two light fittings that looked identical, both manufactured by the same company. The one was mark bearing and cost R25. The other, which looked exactly the same and which was claimed to be the same, was not mark bearing and he was told that this only cost R22 because the mark increased the cost of the fitting by R3,00.

Well gentlemen that, of course, is nonsense. As a result of this, I feel that perhaps I should tell this meeting how we do determine our mark fees. In the first place we make an estimate of our costs to run such a mark scheme and we take into account items such as salaries, subsistence, transport, etc. and, of course, maintenance of equipment. We then inform the producers concerned of the total cost involved and notify them that, to defray the cost, we will have to levy a charge per item, say 1 cent or 2 cents or whatever the case may be. I feel I am on safe ground when I say that in all cases the effect of the mark fee on the production cost of an article is less than 0,5 per cent and very often less than 0,1 per cent. In the case of cables it is very much less than 0,1 per cent, so there is no loading and the claim that we increase prices is of course, as I said earlier, just nonsense. Thank you.

## MR. J. J. BOSHOFF: VANDERBIJLPARK

Mr. President, ladies and gentlemen, I would like to report as follows on item 5-37 of this report.

Project No. 851/5085

Plain-end Metallic Conduit & Fittings for Electrical

Wiring — SABS 1007-1973.

About two weeks ago I received a notice of proposed amendments to this specification from the SABS inviting comments on the proposals, with a return date set at 12 May 1981. One of the proposed amendments concerns the requirements laid down for the strength of joints between conduit and fittings after assembly, and the motivation for the proposal is as follows:—

### SABS 1007 Subsection 6.3 and Table 3

The pull out forces listed in table 3 are considered to be unnecessarily excessive. In practice, electrical conduit is not subjected to axial loads, but, during assembly, it could be possible that an unsupported length could hang from a fitting and, allowing a safety factor of at least 5 on the mass of the conduit, it is proposed that table 3 should be amended to that given below:—

Nominal size of conduit mm	Tensile force N at present	Tensile force N proposed
16	1 500	100
20	2 000	110
25	2 500	165
32	3 000	210
40	3 500	300
50	4 000	370
63	4 000	500

I am not in a position to suggest practical values for pull out forces and could accept that the existing values need revision. However, I disagree that the joints should merely be strong enough to support a length of conduit.

The old "split tubing" or "slip tubing" which was in general use in this country years ago often pulled out at joints due to persons working in the ceiling space subsequent to installation and tramping on it. This often caused the end of the conduit to cut through the insulation of the conductors thus making the conduit "alive" and creating a hazard.

Personally I believe that any metallic conduit system should be made strong enough to prevent damage being done and hazards being created and that these factors should be taken into account in deciding on the pull out value to be specified. I consider this proposed amendment to be very important, but since I do not want to stress my own viewpoint without knowing that I am expressing the views of the AMEU members generally, I would appreciate a directive from this Convention on this point. Thank you.

## MR. J. V. GRANT: SABS

I know a little of the background because we were brought into the picture by a manufacturer who had come to us and said he thought 2 500 odd newtons to pull out a conduit from

a joint was excessive and we had to agree. I think from the point of view using slip conduit, which this is, you can not treat it in the same way as a screwed steel conduit. This has been the mistake. For normal applications such as mounting on the wall or on concrete or for any other purpose, something in the order of 200 or 165 newtons is quite adequate. If you are going to hang or suspend a conduit with a large fitting on the end, then you must not use slip conduit. I think this is really the way to look at it and we only want a realistic method of assessing the pull-out strength of a joint. You must remember that these joints are made in different ways — one way is to screw in a self-tapping screw tangential to the conduit. The actual electrical continuity, although we are not talking about this now, is not so good. The strength is obviously not so good. You can make the joint better by being very careful in your design. But this type of joint will never be as strong as a straight steel conduit and I feel a big reduction is necessary. Thank you.

#### MR. D. H. FRASER: PRESIDENT

I suggest Mr. Boshoff give consideration to that reply and, if he feels it is still necessary to pursue the matter, this should be done via the SABS Co-ordinating Committee. I think we will refer it to the Executive Council Meeting on Thursday.

#### MR. P. J. BOTES: ROODEPOORT

Meneer die President, ek wil graag mnr. Pretorius gelukwens met 'n omvattende verslag wat hy aan ons voorgelê het. Daar is baie deeglik verslag gedoen oor die doen en late van hierdie Komitee en dit is 'n belangrike handeeling aangaande standaardspesifikasies.

Ek wil graag hier net twee aspekte noem. Ons het oor die afgelope paar jaar baie ver gevorder met 'n standaard-spesifikasie vir kruisgebode poliëteleen kables. Is hierdie spesifikasie alreeds goedgekeur deur die Raad en wanneer sal dit beskikbaar wees? Ek wil net noem dat ek baie probleme met hierdie tipe van kabel gehad het oor die afgelope paar maande. Om die waarheid te sê ek slaap nie meer in Roodepoort nie.

Die tipesse foute wat plaasvind is tussen die koper kern en die semi-geleidende omhulsel. Die rede is blykbaar die los halfgeleidende omhulsel van die soort kabel. Ek het 'n tipesse voorbeeld van so 'n fout hier sodat mense daarna kan kyk, asook 'n voorbeeld van die nuwe tipe kabel wat voorgestel word in die spesifikasie.

Dit is belangrik dat ons so gou moontlik van hierdie spesifikasie gebruik maak indien van hierdie tipe kabel aangekoop word. Ekself gaan nie meer daarvan gebruik maak nie.

Meneer die President dan wil ek ook net graag van hierdie geleentheid gebruik maak om te sê dat volgens my sieningswyses aardlekrelêrs nie verpligtend behoort te wees nie. Ons behoort die minimum vereistes te spesifiseer, nie die maksimum nie.

Die Kode is alom bekend as 'n verslapping van die bedravingsmetodes en waarom dit so streng gedoen word in hierdie geval, weet ek nie. Ek wil u vertel wat die tipesse probleme is met aardlekrelêrs.

Aardlekrelêrs het die nare manier om tydig en ontydig uit te klink en dit veroorsaak baie probleme.

U weet ek het die afgelope tyd probleme met verbruikers wat kla dat die oomblik wanneer hulle hul rug draai klink die relêrs uit. Hulle kan nie 'n naweek uitgaan nie want dan klink die aardlekrelê uit en is die ykaka ontvries en met hul terugkeer vind hulle dat alles alreë geword het. Daar is party mense wat beweer dat hulle dit net nie kan bekostig om vir 'n naweek weg te gaan of om met vakansie te gaan nie.

Meneer die President, ek weet nie of dit heeltemal die kor-

rekte optrede is nie, maar daar moet wysigings gedoen word aan die Bedravingskode om ykaste uit te sluit. Daar moet dringend aandag aan hierdie aangeleentheid gegee word.

Baie aardlekrelêrs raak foutief en ek het by verskeie geleenthede die betrokke aardlekrelêrs teruggestuur na die Buro van Standaarde en ook aan vervaardigers. Gewoonlik word daar vir my gesê dat niks verkeerd is met die aardlekrelê, dit is volgens die spesifikasie, ens. Die feit van die saak is dat ek my mense beveel het om 'n nuwe een te installeer wat onmiddellik geen verdere probleme gegee het nie. As die ouer eger weer teruggeplaas word, dan klink dit uit. Daar is dus êrens baie groot fout met die norme van die toetse wat gedoen moet word op hierdie aardlekrelê en ek dink ook dat die perk van 20 milliamperes moontlik te laag is en miskien hersien moet word in die lig van die huidige sieningswyses oor hierdie aangeleentheid.

Ek dink dat die moontlikheid ondersoek moet word om die standaardspesifikasie vir aardlekrelêrs te hersien. Die kwesie van die verpligte installering van aardlekrelêrs in geboue, glo ek moet nie afdwing word nie.

Meneer die President hierdie is 'n ernstige aangeleentheid en ek ondervind baie probleme in hierdie verband. Baie dankie.

#### MR. S. W. CLIVES: AFFILIATE

Mr. President, I would like to refer to the remarks made by Mr. P. J. Botes during which he drew attention to influencing factors on ELCB's.

Firstly, nuisance tripping can be diagnosed almost always as an earth leakage actually appearing on the supply. If he has to change a unit because it has a spurious trip and the nuisance disappears, it is possible the fault on the system has been removed by the installation.

The unit to which he referred may have been made by Heine-mann as we recently were asked by SABS to check a very old unit sent to them from the Roodepoort Electrical Engineer.

The unit was received in a damaged condition, being broken below the area which is critical to the operation of the EL device. It was possible to gain access to the adjustment of stability and it therefore could possibly have been tampered with.

My company contacted, via post, the consumer concerned, but our communication was returned marked "not at this address".

It was therefore not possible to investigate the cause of any spurious tripping on this installation properly.

Nuisance tripping should always be investigated on the installation itself as, to us, it is always obviously the installation that is at fault and that is why Mr. Botes gets confused when the SABS or Manufacturer reports there is nothing wrong with the unit.

A further point is that the unit was rather old and newer units are much improved.

Nuisance tripping is caused almost wholly by system standing earth faults, which have supply disturbances imposed over and above them.

Nuisance tripping is also caused by lightning strikes which reach the LV system. Municipalities could obviate much of this by fitting LV surge arrestors before the ELCB.

There are other causes of nuisance tripping and all such causes can be analysed and mostly overcome.

As far as sensitivity is concerned, it should be obvious that if, say, a 50 mA unit is used it will be much less prone to spurious trips. However, one simply buries any small standing earth faults. A 50 mA unit is also quite safe from a shock hazard point of view.

Having regard to Indirect Protection and Fire Protection one could move to higher sensitivities of say 100 mA or 300 mA and this may become a future trend with higher sensitivities of 30 mA placed directly in the panelboard sub circuits only to protect socket outlets, where most of the trouble occurs.

It is important to stress that any reduction in the use of ELCB's will undoubtedly increase electrical accidents in the home.

With these remarks Mr. President, I hope to have cleared up a few misconceptions. Thank you.

# The new Bosal LOCFIT Conduit is here.



Introducing the unique electrical conduit with positive advantages.

## • LOW COST, EASY INSTALLATION

The advanced Bosal method of joining, which eliminates the threading operation, reduces installation costs to the minimum.



## • LONG LIFE

Bosal Conduit is made of ISCOR pre-galvanised steel and the threadless method of joining maintains optimum strength and eliminates damage to protective surface.

## • ALL THE ACCESSORIES YOU NEED

to couple to other systems are readily available.

## INSTALLATION

1. Ensure that the outside of the straight end and the inside of the expanded end are clean.
2. To effect a waterproof joint, apply epoxy adhesive to the straight end to form a thin layer of adhesive approximately 1 cm wide round the pipe (50 ml will do approximately 360 joints on a 20 mm diameter conduit).
3. Push the straight end into the expanded end.

## SABS

The Bosal Conduit carries a fully approved SABS mark meeting the specifications 1007/1973 for plain-end metallic conduits and fittings for electrical wiring.



## FOR ENQUIRIES CONTACT:

**BOSAL AFRIKA (PTY) LTD.**

P.O. Box 52, Uitenhage 6230

Telephone (0422) 29014

P.O. Box 186, Cape Town 8000

Telephone (021) 542751

P.O. Box 3344, Durban 4000

Telephone (031) 713267

P.O. Box 1652, Pretoria 0001

Telephone (012) 835211



**bosal**  
TUBE DIVISION



# REPORT OF THE TECHNICAL TRAINING COMMITTEE FOR THE PERIOD 1979/81

## 1. Composition of Committee

The following members of the AMEU were appointed to this Committee by the Executive Council at its meeting held on 2 March, 1979.

J. D. Dawson	Uitenhage
A. H. L. Fortmann	Boksburg
D. H. Fraser	Durban
J. A. Loubser	Benoni
D. C. Palser	Cape Town

Two meetings of the Committee were held during the period under review to consider matters of concern to the Association in the sphere of technical training.

## 2. Revised Examination Procedure for Government Certificates of Competency

In the last report of the Technical Training Committee reference was made to the introduction of a revised system of examination for Government Certificates of Competency whereby examinations conducted by the Commission of Examiners on behalf of the Government Mining Engineer and the Chief Inspector of Factories were to be limited to two subjects, namely Plant Engineering and the relevant Act and Regulations. Candidates are required to have an appropriate university degree or to have passed certain specified subjects in a course for the National Diploma for Technicians.

The success rate to date in the subject Plant Engineering has been very low as seen in the following results.

	June 1979	Nov. 1979	June 1980
No. writing Plant Engineering	27	50	80
No. who passed Plant Engineering	1	3	14
Percentage pass rate	4%	6%	18%

The examination in Plant Engineering is heavily biased towards mechanical engineering subjects and it appears unlikely that students following the present syllabi for the National Diploma or National Higher Diploma in Electrical Engineering will stand much chance of passing this examination without considerable additional study after obtaining the Diploma.

## 3. Amendment to Professional Engineers Act No. 81/1968 & Regulations

After consideration by a Select Committee, the draft Bill to amend the Professional Engineers Act, referred to in the last report of the Technical Training Committee, was submitted to the 1979 Parliamentary session and passed as the Professional Engineers Amendment Act No. 77/1979.

This legislation is of interest to Municipalities in that, inter alia:

- (i) it extends the application of the Act to Local Authorities, and
- (ii) it makes provision for the establishment of Boards of Control for persons possessing technical qualifications not recognised for registration as a professional engineer.

In respect of (i) above it is proposed, in terms of Notice R.683 published in Government Gazette 6928 on 3 April, 1980 to exempt local authorities from the provisions of the Act for a period of five years. Thereafter it will be necessary for municipalities to ensure that all work which is reserved for Professional Engineers is carried out by or under the close supervision of a Professional Engineer.

Regarding (ii) above, a committee known as the Interim Committee for the Registration of Technologists and Engineers, on which the AMEU is represented, has met on a number of occasions during the past two years to examine

the desirability of establishing a Board of Control for the registration of Technicians, Technologists and Engineers who do not satisfy the qualification requirements for registration as Professional Engineers. Little progress has been made to date in this regard and considerable difficulties are foreseen in obtaining consensus on the question of registration on account of the wide diversity of semi-professional technical qualifications and the absence of a single representative body.

## 4. East Rand Joint Municipal Training Centre

This training centre which is jointly financed by eight East Rand municipalities is located in Benoni and commenced operation in January, 1979. As at the beginning of January, 1981, 135 apprentices had received institutionalised practical training in the trade of electrician and 53 as motor mechanics. The training is designed to supplement "on the job" practical training and prepare apprentices for the qualifying trade test at the Central Organisation for Trade Testing (COTT). Of the 46 apprentice electricians who have taken the trade test after spending a period in the Training Centre 81% have passed which represents a marked improvement of the success rate previously obtained and proves the value of such training centres where specialised tuition in basic skills, methods and techniques can be given. In the case of apprentice motor mechanics 93% of the 18 prepared for the trade test passed.

## 5. Training of Professional Engineers

Johannesburg and Port Elizabeth are still the only two municipalities to have training programmes approved by the South African Council for Professional Engineers.

## 6. Apprenticeship Committee for the Local Authority Undertaking, Northern Transvaal

From time to time members of the AMEU have expressed concern that the training schedule prescribed by the Apprenticeship Committee for the Metal Industry for apprentice Electricians, under which most municipal apprentices are indentured, departs substantially from the scope of work of a municipal electrician. With a view to overcoming this disadvantage and to bringing about uniform conditions of apprenticeship for all trades practiced in municipalities, certain local authorities and other interested parties recently took steps for the establishment of an Apprenticeship Committee for the Local Authority Undertaking in the Northern Transvaal.

This Committee was established in terms of Notice R.1976 published on 7 September, 1979 in Government Gazette 6649 and the proposed designation of trades, conditions of apprenticeship and training schedules were published in Government Gazette 6794 on 28 December, 1979 in Notice No. R.2868. This provided for any objections by interested parties to be lodged within a period of 30 days.

The proposed conditions and training schedules were examined by the AMEU Technical Training Committee at a meeting held on 15 February, 1980, following the lodging of an objection by the Highveld Branch, in a letter dated 28 January, 1980. The Committee considered that the proposed practical training schedule for electricians required amendment to include training in overhead line and street lighting work and that the depth of training prescribed in basic electronics went considerably beyond the scope of the average municipal electrician's job. It was also agreed that the specified minimum practical training period of 78 weeks was insufficient and recommended that this be increased to 93 weeks. A memorandum setting out the views of the Training Committee was subsequently forwarded to the Secretary of the relevant Apprenticeship Committee but, despite the AMEU objections, the original proposals were made effective from 11 April, 1980 in terms of Notices R.705 and R.706 published in Government Gazette 6941.

At the beginning of 1981, 39 Apprentice electricians were registered in training under the new Apprenticeship Committee for the Local Authority Undertaking. Several apprentices whose contracts were changed from the Metal Industry to the Local Authorities Undertaking have already passed the qualifying trade test. It is however understood that COTT have not yet introduced a trade test covering the specific training schedule for Local Authority apprentices and it is considered necessary that this be done at an early date.

#### 7 Shortage of Municipal Electrical Engineering Staff

As recorded in the proceedings of the 46th Convention of the AMEU, the Technical Training Committee has given consideration to representations made by the Highveld Branch to the Executive Council regarding the critical shortage of engineering staff being experienced by municipal electricity supply undertakings.

In order to obtain factual information on the extent of the shortage of technical staff a suitable questionnaire was sent to all AMEU member undertakings. The response to this was very good and from the information submitted it was obvious that the shortage of both professional and semi-professional engineering staff was seriously prejudicing the ability of municipalities to function effectively and fulfil their obligations as suppliers of electricity.

A memorandum on the subject prepared by the Technical Training Committee (copy attached) was approved by the AMEU Executive Council at its meeting held on 8 May, 1980 for submission to the United Municipal Executive (UME). This was considered by the UME at its meeting in August, 1980 when the matter was referred to its Action Committee with a view to formulating a programme of action to overcome the shortage of municipal staff in general and engineers in particular.

#### 8. AMEU grants and awards

Apart from surveying the overall staff shortage problems, bringing the seriousness of the situation to the

Vacancies for Professionally qualified Engineers	---	---	---	---	---	---	---	---	73	25
Vacancies for semi-Professionally qualified Engineers	---	---	---	---	---	---	---	---	75	24
Total vacancies for Electrical Engineering staff	---	---	---	---	---	---	---	---	148	24

2.2 It appears from the survey that no less than 17 electricity supply authorities had no head of their electricity department.

2.3 The serious shortage of Electrical Engineering staff is evident in small, medium and large Undertakings. Several small authorities are operating entirely without a suitably qualified man in their employ while three large Cities in the Republic have Electrical Engineering staff shortages ranging from 17 to 50% of their total establishments.

2.4 The majority of authorities report a poor response to recruitment efforts and it is known that advertised vacancies frequently attract no replies whatsoever from appropriately qualified persons.

#### 3.0 AMEU Executive Council's Concern

The Executive Council of the AMEU views the prevailing shortage of Electrical Engineering staff among members Undertakings in a very serious light and is concerned that this situation is harmful to the National interest, in that Undertakings affected by such staff shortages will be unable to discharge their important obligations in respect of the supply of electricity, adequately or efficiently.

3.1 The Executive Council considers that it would be failing in its duty if it were not to make known its concern in this matter to the United Municipal Executive and to request that urgent attention be given to improving the recruitment and retention

attention of appropriate authorities, and suggesting steps which member undertakings may take to alleviate difficulties arising from the general shortage of technically trained manpower prevailing in South Africa, there appears little else that the AMEU can do in this regard. However, in order to provide some encouragement to individuals and to give publicity to the employment opportunities available in municipal electricity undertakings, the AMEU Executive Council recently authorised the granting of two bursaries valued at R1 000 per annum each to deserving students studying electrical engineering at any South African University. In addition awards of R100 per annum each have been made available to municipal apprentice training establishments for allocation on behalf of the AMEU to deserving apprentices.

D. H. FRASER, Convener

### MEMORANDUM: SHORTAGE OF MUNICIPAL ELECTRICAL ENGINEERING STAFF

#### 1.0 Introduction

At its meeting held on 9th November, 1979 the Executive Council of the Association of Municipal Electricity Undertakings of South Africa (AMEU) gave consideration to a report by its Technical Training Committee concerning the prevailing serious shortage of Electrical Engineering Staff among member Undertakings.

#### 2.0 Survey of all Municipal Electricity Undertakings

Following complaints from a number of Municipalities of difficulty or inability to fill key vacant posts with the required professional or semi-professional staff, the AMEU conducted a survey among its member Undertakings in October, 1979 to determine the extent of the problem.

2.1 The following facts emerged from the response to the questionnaire which was circulated:—

Percentage of  
No. Establishment

of Electrical Engineering staff in the sphere of Local Government.

#### 4.0 Analysis of the Problem

4.1 It is accepted that a general shortage of engineering manpower exists at present throughout the Republic. This is confirmed in a recently published report on a survey carried out by Dr. P. Lloyd, Mr. P. Scribante and Professor D. de Vos for the Federation of Societies of Professional Engineers. The report identified the basic causes of the shortage as —

- (a) a sharp decline in the rate of immigration of Engineers from about 1976;
- (b) an inadequacy in the number of Engineers being trained in South Africa.

It was predicted that, provided recruitment of Engineers from abroad is restored to the level achieved in 1975 during the early 1980's, the demand for Electrical Engineers would be met only to the extent of 70 to 80% by 1982.

4.2 In the competition for the inadequate number of Electrical Engineering staff available it is obvious that Municipalities are losing out badly to the private sector and are not obtaining their fair share of the limited labour force available.

The reason municipalities are not obtaining their fair share of the limited available labour force is

that the private sector is paying appreciably more at senior level than is the public sector. The reason for this is obvious, namely the profit motive. Private firms are forced to pay high salaries to ensure that they have sufficient and competent staff. Otherwise they would not be competitive in the market and there would be reduced profits for distribution to management and shareholders.

To stay in business private firms are accordingly obliged to pay the going rate. Any increase in the salary and wage bill on this account is merely passed on to the end consumer, namely the public or man in the street.

In the case of municipal electricity undertakings there is no profit motive. But should salaries and wages be lower than those paid by the private sector on this account? Definitely not! If anything the public sector should endeavour to obtain the best possible staff since generally essential services are involved and public authorities, unlike the private sector, cannot regulate the quantity of work undertaken to suit the availability of staff. In the final account it is still the man in the street who has to foot the bill!

It is strongly recommended that municipalities should urgently review the levels of remuneration of staff, in areas where shortages exist, to ensure that these are realistic in relation to the private sector.

#### 4.3 Municipal salaries are generally comparable, one municipality with the other.

The salaries of Town Clerks are subject to control by Provincial Authorities and this limitation usually, but not necessarily, results in a corresponding limitation in the remuneration of other municipal departmental heads. The compression of municipal grading structures through the artificial restraints on top salary levels has progressively lowered the salary gradients in organisations over recent years with adverse effects on employee motivation and recruitment to promotional levels. The Executive Council strongly urges that representation be made for the elimination of the restrictions on the salaries of Town Clerks.

If this cannot be achieved it is recommended that other municipalities should consider following the course adopted by one large municipality by raising the salaries of the heads of engineering and certain other departments above that of the Town Clerk, who could, if necessary be compensated through additional perks.

#### 5.0 Summary

A serious general shortage of adequately trained professional and semi-professional Electrical Engineering staff exists in the Republic at present. Unless urgent measures are taken to alleviate the position Local Authorities will be increasingly unable in the future to fulfil the role of providing adequate supplies of electricity to consumers within their areas of jurisdiction.

#### 6.0 Recommendations

The AMEU Executive Council recommends that the following action be taken as a matter of urgency by the UME.

6.1 Local Authorities should be urged or required to participate adequately in, or contribute to, the training of staff to fill Professional or semi-Professional posts in municipal electricity undertakings, utilising the total manpower resources available to them, regardless of race, by offering appropriate loans, bursaries or scholarships for academic study and arranging suitable practical training.

6.2 Local Authorities should be advised to consider possible recruitment of technical staff from overseas countries.

6.2 Local Authorities should be advised to consider possible recruitment of technical staff from overseas countries.

6.3 Steps should be taken to ensure that Local Authorities are able to compete fairly in the labour market for available personnel by being allowed to offer remuneration and service conditions comparable with those offered by other employers, particularly those in the private sector. This will entail the removal of present controls on the remuneration of municipal heads of departments and in particular the restrictions placed on maximum salaries payable to Town Clerks as this generally results in a corresponding limitation in the remuneration of other departmental heads, including the official in charge of the Electricity Undertaking.

6.4 Local Authorities which are experiencing difficulty in recruitment and retention of Professional and semi-Professional electrical engineering staff should be advised to examine and if necessary revise salary structures and conditions of employment to ensure that these are reasonably competitive.

P. J. BOTES, President

#### MR. J. A. LOUBSER: BENONI

Mr. President, I must congratulate you on a very comprehensive report. I only have a few comments to offer as a supplement to the report.

#### 1. REVISED EXAMINATION PROCEDURE FOR GOVERNMENT CERTIFICATE

I think it must be pointed out that both certificates, viz. Mechanical and Electrical, are acceptable to the Chief Inspector of Machinery.

#### 2. PROFESSIONAL ENGINEERS ACT

It should be pointed out that during discussions with Mr. Gericke, he explicitly said that people who were doing a certain job prior to the coming into force of this amendment will be allowed to continue to do so, but whenever a vacancy occurs it will have to be filled by a professional engineer.

#### 3. EAST RAND JOINT MUNICIPAL TRAINING CENTRE

Mr. President, if there was ever money spent wisely, then it is in this training centre. I can tell you that at present it is completely impossible to obtain any artisans from outside. All newly appointed artisans come through the training centre. Through the kind co-operation of the Town Treasurer of Benoni, we recently acquired an additional building which is at present being equipped for the motor mechanic apprentices. This will allow us more space in the electrical section for additional training aids. Arrangements have already been made for the Chief Training Officer to visit your training centre and many improvements are envisaged in the near future. I can report that the latest pass rate was 83% for electricians and 96% for motor mechanics. Recently an apprentice from Boksburg passed with the highest marks obtained in the Republic.

#### 4. APPRENTICESHIP COMMITTEE FOR LOCAL AUTHORITIES

It is a bit disappointing that no trade test covering the training schedule for local authorities has been introduced. Perhaps Mr. Hare from COTT would like to comment.

#### 5. AMEU GRANTS AND AWARDS

I personally feel that an amount of R1 000 for a bursary for an engineering student is too low. I think the Executive Council should reconsider these bursaries.

Mr. President, recently one of our nearby towns advertised a post for a student engineer at a salary in the region of R400 per month. The idea is to appoint somebody as a full time student. Every holiday the student will have to work for the Council concerned and he will be entitled to all Municipal benefits such as leave, pension, group life insurance and medical benefits. However, he must be willing to sign a contract to work for the Council for 15 months for every year as full time student. Thank you.

#### MR. C. ADAMS: PORT ELIZABETH

Mr. President, I just wanted to ask a question with regard to the Industrial Council for the Supply Industry or the Local Authorities Industrial Council in the Northern Transvaal. I was very surprised to read the comment in the report that, as regards the Training Syllabus, the AMEU or Highveld Branch had not been able to exercise any influence on the content of this syllabus. Now, I may be wrong, but I understood that this Industrial Council came into being at the request of the local authorities.

If that is the case and the local authorities and the AMEU cannot exercise interest or influence on the Training Syllabus, what is the benefit of having an Industrial Council? Does it benefit the local authorities in any way at all?

#### MR. D. H. FRASER: PRESIDENT

Thank you Mr. Adams for that rather awkward question. Is there anybody from the Highveld Branch who could answer it or anyone who was concerned with the establishment of this Apprenticeship Committee?

#### MR. L. HARE: COTT

Mr. President, there exist about 17 or 18 industries throughout the country, each of which has a National Apprenticeship Committee, and when the employer, the Trade Unions or the Workers Representatives decide on a new trade or alterations to the training schedule of a trade, they start at the relevant Apprenticeship Committee level. From there it goes to the National Apprenticeship Committee and after it has been thoroughly discussed by both the workers and the employers concerned, it goes to the National Apprenticeship Board. The registrar of Apprenticeships is the Chairman of this Board and if it is approved by the Board it gets Gazetted in terms of the Apprenticeship Act. It becomes part of the Act. The point here is that the Municipal Undertakings of Northern Transvaal decided, for certain reasons which I think are quite valid, to have their own Apprenticeship Committee and the Apprenticeship Committee studied the training schedules of various other industries, selected certain of them, kept some of them as they were, re-wrote others and in the case of the electricians, they put in basic electronics. They were following in the footsteps of the Railways and other Government organisations have now also introduced electronics for electricians. The training schedules are not devised by COTT in any way. They are handed to us after having been Gazetted, when they become obligatory on the employer.

Paragraph 7 of nearly all of these Gazettes says: "The employer shall train the apprentice in accordance with the schedule attached hereto. That is the law. When a new subject is brought in like Basic Electronics, we normally allow one year before we start Trade Testing in that particular subject. When we started testing the Railways apprentices in basic electronics, we gave them a two hour test and dropped one of the other jobs out of the test so that they still had to do five. It has been very successful and we have had quite a number of passes with distinctions, and when the Municipal Undertaking of Northern Transvaal gazettes this particular schedule, we will start Trade Testing. I must make an appeal here. Not every employer has at the moment the facility to train its electricians in this particular field and I appeal to all members to ensure that their instructors or apprentice supervisors, when they apply via LAB 615 form for a Trade Test, endorse in the margin whether or not the candidate has undertaken a course in electronics. Immediately that happens we will include basic electronics in his Trade Test.

I think that if the members will comply with this request, we will then know who has undergone the course and training. It would be quite unfair to trade test an apprentice in basic electronics when he not received any instruction. We will expect, after a reasonable period, that the employers concerned will start endorsing their applications for trade tests for the apprentices to the effect that the apprentices have received the necessary training in electronics and we will then test them. I think that is what is probably disturbing some people, and I hope that I have cleared up any misconception there. Thank you.

#### MR. W. BARNARD: JOHANNESBURG

Mr. President, the "verligte" members in the Transvaal, decided that we wanted our apprentices trained in the broader

sense of the industry rather than as municipal electricians for the very good reason that we are already experiencing great difficulty in recruiting apprentices. We feel that if we offer them a training in municipal electrical work only, it's going to restrict the recruitments even further. Thank you.



Mr. D. H. Fraser presenting Mr. H. R. Wood with the AMEU award for the most deserving student of the Johannesburg Technical Training Centre.

#### MR. K. J. MURPHY: SOMERSET WEST

Mr. President, I refer to Item 3 of the report, i.e. the Amendment of the Professional Engineers Act to enforce the provisions of the Professional Engineers Act on Local Authorities. Invitations for objections to the draft bill were invited and I am sure many must have been received.

The AMEU, in terms of its Constitution, is duty bound to look after the interests of all its members of which the majority are probably not registered Professional Engineers.

We appreciate, Mr. President, your sympathetic remarks in this regard as contained in your address. We do however, look to our Executive Council, which incidentally, is composed almost entirely of Registered Professional Engineers to display understanding for the problems of their unregistered colleagues.

#### MR. J. J. BOSHOFF: VANDERBIJLPARK

Mr. President, the amendments to this act were published in Government Gazette No. 7398 of 6 February 1981 and in terms of section 3 exemption is granted to:

3. "Any public utility corporation or . . . which for reward performs or causes to be performed by any person employed by it in a salaried position, for any other person, whether a natural or juristic person, any kinds of work reserved for professional engineers in terms of section 7(3)(c) of the Act: Provided that —
- 3.2 not later than five years from the date on which section 21 (1A) of the Act comes into operation, such public utility corporation or public utility company or such other juristic person shall arrange for work reserved for professional engineers in terms of section 7(3)(c) of the Act to be performed by or under the direction or control of a professional engineer."

I cannot think of any work normally performed by engineering staff of a municipality which is performed for reward for any other person and for this reason I fail to see how municipalities are affected by this amendment to the Act. If my reasoning is wrong I would like to be shown where I am making a mistake.

#### MR. D. H. FRASER: PRESIDENT

Thank you for that contribution Mr. Boshoff. As far as I am aware it does apply to local authorities. There is an exemption provided for five years but as I understand it, after that time the provision to the Act will apply to local authorities. But this is a question that we should refer to the new Training Committee for closer examination. Perhaps I can ask you, Mr. Boshoff, if you could submit something in writing to the Secretary and this can be passed on to the Training Committee for consideration.



# REPORT OF THE SUB-COMMITTEE ON THE ELECTRICAL WIREMEN AND CONTRACTORS AMENDMENT ACT

In the report to the 46th Convention held in Johannesburg in 1979, it was mentioned that the proposed draft on the Electrical Wiremen and Contractors Amendment Act had been withheld pending the outcome and final acceptance by the Government of the recommendations of the Wiehahn Commission of Enquiry into Labour Legislation which, inter alia, also included the Electrical Wiremen and Contractors Act 1939.

The findings of the Commission in respect of the Act have been made known and the decisions and views of the Government were published in a White Paper during November 1980 which can be summarised as follows:—

1. Repeal of the Act and provision to be made for the safety aspects of wiring and wiring work in regulations to be made under the Occupational Health and Safety Act (previously known as the Factories Act) with specific provision for —
  - 1.1 An approved national wiring code for electrical installations
  - 1.2 Safety aspects relative to wiring and wiring work
  - 1.3 The inspection of wiring work by suppliers insofar as it is necessary and practical and in the interests of safety
2. The Government's view is that the compulsory general registration of electrical wiremen to allow only registered persons to do wiring work be done away with and that the objects of the Act can be achieved if only those persons who are charged with the overall supervision of wiring work and those who have to inspect, test and approve electrical installations are subject to registration.
3. The Government's view is that the contemplated regulations should make provision for the registration of electrical wiremen for the abovementioned purposes on the basis of qualifications prescribed by regulation and that wiremen at present registered under Section 11(2)(a) of the existing Act be deemed to be registered under the intended new system.
4. In view of the Government's decision as set out above, the continued existence of the Electrical Wiremen's Registration Board will serve no further purpose.

The necessary machinery has been set up to draft the contemplated regulations referred to above and a progress report will no doubt be given at the Convention by the Chief Inspector of Factories during the Session allocated to him on the morning of the second day of the Convention.

The activities of this particular Subcommittee can therefore be discontinued in future.

J. K. VON AHLFTEN, Convener

# REPORT OF THE AD HOC COMMITTEE TO INVESTIGATE LEGISLATION AND PRACTICES FOR WIRING WORK IN SOUTH AFRICA

## 1. Introduction

One of the statements in the report submitted to the Convention in 1979 on the overseas study tour to investigate new wiring systems was to the effect that useful information was obtained concerning the training and registration of electrical wiremen and the inspection and testing of electrical installations and the recommendation was made that legislation and practices in this country in this regard should be re-examined in the light of procedures in use in Britain, Germany and France.

An ad hoc Committee was therefore set up to investigate and report its findings in this respect with Mr. J. K. von Ahlften as Convener and Mr. D. H. Fraser, Mr. E. de C. Pretorius and representatives from other organisations directly concerned with these matters as members.

## 2. Progress Report

The ad hoc Committee, however, came to the conclusion that there was little to be gained by endeavouring to establish an equivalent to the British National Inspection Council for Electrical Installation Contracting until such time as suitable legislation has been introduced amending the present requirements for the registration of electrical wiremen and contractors and inspection and testing of wiring work.

## 3. Conclusion

In view of the decisions by the Government, following the Wiehahn Commission's recommendations in respect of the continued inspection of wiring work by suppliers, that only those persons charged with the overall supervision of wiring work and those who have to inspect, test and approve wiring work be subject to registration, the objectives of this ad hoc Committee appear to have fallen away, and it is recommended that the Committee be disbanded.

J. K. VON AHLFTEN, Convener

# REPORT ON THE ACTIVITIES OF THE ELECTRICAL WIREMEN'S REGISTRATION BOARD

## 1. Introduction

Because of the decisions of the Government arising from the recommendations of the Wiehahn Commission of Enquiry into labour legislation that the Electrical Wiremen and Contractors Act be repealed and that the continued existence of the Electrical Wiremen's Registration Board as such will serve no further purpose, this will probably be the last report on the activities of the Board.

The reasons for these decisions were clearly set out in the White Paper published during November 1980 and therefore do not warrant repetition here. The recommendations in the White Paper are to be welcomed as far as the suppliers are concerned because they will lead to a better utilisation of the available labour force in the electrical contracting industry and ease the task of suppliers in exercising control over wiring work being performed by registered wiremen in future.

## 2. Activities of the Board for the Period 1978-1979

The departmental report on the activities of the Board for 1980 will only become available at the beginning of February 1981, therefore as this report had to be submitted to the Secretary by the end of January 1981 it will be confined to the activities of the Board during the period 1978 to 1979.

During this two year period the Board held 20 meetings and considered 1 796 applications for registration. Of this number 1 738 persons were either accepted for the Board's examinations or were exempted for the whole or parts of the examinations.

The Board also granted provisional registration certificates or approved the renewal of such certificates in respect of 1 414 applicants. The applications of 296 persons were refused.

Particulars of full registration certificates issued since the Act came into operation are reflected hereunder:—

Year	To applicants who passed during the examinations exempted from the examinations		Totals
	1979 or in previous years	1979	
1940-1974	3 177	10 038	13 215
1975	18	406	424
1976	11	433	444
1977	18	370	388
1978	11	406	417
1979	29	378	407
Totals	3 264	12 031	15 295

Particulars of the number of provisional registration certificates issued over the last five years (excluding renewals thereof) are as follows:—

Year	Number
1975	608
1976	416
1977	316
1978	194
1979	223

### 3. Conclusion

In concluding this report it would be appropriate to express this Association's sincere appreciation to the Chairman and members of the Board for the spirit of co-operation and understanding extended to suppliers in the administration of the Act over the many years that the

AMEU has been involved in the activities of the Board. As your representative on the Board since 1969, I also wish to record my appreciation for the competent manner in which the Secretary of the Board has always executed his duties. There is no doubt that, under the new legislation to be introduced in accordance with the decisions of the Government regarding wiring work and the registration of wiremen in future, this spirit of co-operation will be maintained.

**J. K. VON AHLFTEN, Representative**

### MR. J. K. VON AHLFTEN: SPRINGS

Mr. President, I would like to refer to the last paragraph where I made the observation that this committee could be disbanded. I think, however, that we will have to maintain this committee in view of the regulations drafted for electrical installations. Regarding the Report on the Wiremen's Board, this is probably the last report that will be submitted to an AMEU Convention on the activities of the Board, as I take it that the Board will not function once the Act has been scrapped. I would, however, like to mention that since the report was written the Secretary of the Board passed away suddenly and I do express this Association's appreciation of the competent manner in which the Secretary performed his duties in the nine years that I have been associated with the Board.

I would also like to thank Mr. Welch for his support through all these years and I am sure that under the new legislation we will have the same support.

Coming to Report No. 10, on the legislation, I think that Mr. Welch does not quite agree with what I have said in this report and he feels that this committee should still pursue this matter. So, without wasting any time Mr. President, I suggest that we have these three reports open for discussion, if there is anything to be discussed and decided. Thank you.

### MR. A. A. WEICH: CHIEF INSPECTOR OF FACTORIES

Mr. President, I would like to ask you not to bury a patient before he is dead and that is the Electrical Wiremen's Contractors Act. Until such time as the regulations are promulgated and the old Act is definitely withdrawn we carry on as usual.

On the question of the Ad hoc Committee of the AMEU which had negotiations with the Electrical Contractors Association with respect to the possibility of having some body similar to that which they have in the United Kingdom as an Electrical Inspection Council.

I personally, like the idea and would like to see it pursued. That is not so much because of my concern for the Electrical Contracting Industry, because I always call them my 'forty thieves' and I believe that is how I feel about them. But the point is that, if these new regulations should become promulgated, the question of inspection will still be one that local authorities will have to deal with, but on a more adult basis. It will be a question of deciding which particular contractor should be inspected more often than others. You will only be able to decide that if you know the firm and type of person you are dealing with. Now the Electrical Inspection Council is really an organisation comprising the public, users and suppliers and of course Electrical Contractors. They monitor the quality of the Contractors' work. It is a quality guarantee system and I think we need it in South Africa, so I would like you to pursue that matter further and see if you cannot make something of it.

### MR. D. H. FRASER: PRESIDENT

Thank you Mr. Welch. We cannot ignore your valued opinion and I am sure we will give consideration to that. In regard to Report No. 8, that is on the Electrical Wiremen's Registration Board, Mr. Hare from the Central Organisation for Trade Testing has asked to speak.

### MR. L. H. HARE: COTT

Mr. President, I wish to make a few comments as to the future trade testing and status of electrical wireman.

The Central Organisation for Trade Testing conducts practical and written trade tests and examinations in terms of Acts of Parliament. The Apprenticeship Act of 1944, as amended, makes no provision for any formal written examination, but stipulates that apprentices in possession of an N2 Certificate, with the appropriate trade theory as a subject may undergo a trade test at Olifantsfontein after a prescribed period of practical training. This period of practical training varies according to which of the approximately 18 Industries the apprentice is indentured to. Provision is made in the Apprenticeship Act for the candidate to be paid subsistence and travelling costs and he is issued with a free rail warrant if he lives beyond a certain distance from the Trade Test Centre. This applies to all apprentices, including electrical wiremen.

The Electrical Wiremen and Contractors Act makes no provision for subsistence and travelling allowances, neither does the Training of Artisans Act (Act 38 of 1951). The Electrical Wiremen & Contractors Act has been administered by the Department of Manpower Utilization, via the Electrical Wiremen's Registration Board, of which the Chief Inspector of Factories is, ex officio, the Chairman. The Board has in the past prescribed the standard and content of its examination requirements for registration of electrical wiremen and, in 1960, delegated these examination requirements to the COTT, as well as prescribing the content and standard of these examinations. As the relevant Act makes no provision for the payment of subsistence and travelling allowances to candidates, and in order to avoid lost or wasted man-hours (or man-days), the Board required the COTT to conduct the practical examinations at a number of so-called outside centres, of which there existed at one time about 13. The number has been reduced, for various reasons, to 9 or 10 at present. This does not apply to apprentice wiremen, who undergo the practical test at Olifantsfontein in the same manner as all other apprentices trade tested in terms of the Apprenticeship Act.

With the impending repeal of the Electrical Wiremen and Contractors Act and the possible provision in the Regulations of the Factories Act of certain provisions contained in the old Act, the provision of the outside centres will fall away and all candidates for registration who are not apprentices will be tested at Olifantsfontein in terms of the Training of Artisans Act (i.e. Act 38 of 1951).

Although finality has not been reached, it would appear that the sole function of the Electrical Wiremen's Registration Board will in future be restricted to the registration of wiremen on production by the candidate of proof of artisan status, either by means of a completed apprenticeship or a trade test pass in accordance with the provisions of the Training of Artisans Act. I have no definite news of how the proposed or possible amendments to the Regulations of the Factories Act will require proof of theoretical examination standards,

nor of the requirements of knowledge of the SAIBS Code of Practice for the Wiring of Premises. The possibility cannot be excluded that the Board will require production of an N3 or higher standard certificate for trade theory, and there is no present indication of what the requirements regarding the standard of knowledge of the Code of Practice will be.

It is possible the Board will accept the relevant N certificate issued by the Department of National Education, but I am sure the latter Department will not conduct an examination concerned with the Code as a National Examination subject. The possibility cannot be excluded that the Regulations will make provision for the Board to appoint an examining body, or bodies, to cater for both the theory examination and that concerning the Code of Practice. It is possible that the COTT may be appointed, as in the past, and that exemption or acceptance of certain N certificates may be provided for in the proposed Regulations.

All that is certain is that drastic changes in the function, status and examination requirements for registration of electrical wiremen will take place in the foreseeable future. I feel sure that any changes made will be in the interests of both the future wiremen and the industry as a whole.

In conclusion, I wish to thank this Convention for the opportunity to address the members on this question and also for the privilege of being allowed to attend the AMEU conventions and technical meetings, and the co-operation extended by members to the COTT as a whole, and to me personally. MR. A. A. WEICH: CHIEF INSPECTOR OF FACTORIES MR. President, Mr. Hare, I would just like to stress that the Wiehahn Commission recommended that, with the scrapping of the Act, the Electrical Wiremen Registration Board should also be abolished, for good I hope. The position is that we are drawing up draft regulations and I may as well advise you that these are going to be circulated within the next fortnight. You will have them, possibly, for a month or two for comment. They make provision for only one registration and only one type of person, whom we call the respon-

sible person, and that is the Installation Supervisor. This man will be responsible for the installation. He will have to inspect it and hand a certificate to the supplier to the effect that installation complies with all the regulations.

The industry needs a good class of person for this purpose, and needs a type of man who can really take charge of a job. In other words, we want a man who is more a technician. There are many good men amongst artisans and I have every respect for them. I have learnt a lot from them in my time, but we require the type of man whom one could call a technician. It is not our job to create technicians, there are other authorities who will do training, but we must see that the people who are registered for this purpose can fulfill this particular function of technician in the industry.

I would just like to say, of course, that all people who are already registered in terms of the Act will, for the purpose of the new regulations also be registered. Obviously, we are not going to take away anybody's privileges. But there is going to be a new Act, and that is the Manpower Training Act and all training is going to be done under the umbrella of that Act. We are going to rely on that Act to supply the people.

I am not going to make these decisions myself and I believe, and I have the assurance to this effect of the authorities drafting this Act, that the industry will be consulted all the way when it comes to the operation and administration of the Act. So the industry will have its say in the qualification required of people and I, in turn, will be guided by that. So we are going, possibly, to accept only those people, in the first instance, who actually pass a trade test. People who have merely become artisans in the fulness of time will have to prove their efficiency, and not just produce a lot of references from long-suffering employers.

It is not for me to say who will do the training and the testing, but I think it will be done by COTT in any case.

Thank you.

## AMEU CODE OF PRACTICE FOR THE APPLICATION OF NEUTRAL EARTHING ON LOW VOLTAGE DISTRIBUTION SYSTEMS

### Introduction

Multiple earthing systems were first established in Europe in 1940 as a means of overcoming the increasing difficulty of obtaining efficient earths for LV distribution networks and consumers' premises. This was consequent on the deterioration and loss of what hitherto were acceptable and reliable earths, viz. underground metallic water mains and buried electrodes.

The principle of allowing consumers to connect their Earthing Lead to the Supply Authority's neutral was legalised in Britain several years ago by the introduction of several Multiple Earthing Approvals.

These Approvals permitted consumers' premises and street-mounted distribution equipment to be earthed to the supplier's neutral, subject to compliance with certain conditions.

1. This Code of Practice deals with the design and installation requirements of applying various methods of multiple earthing to a low voltage (LV) distribution scheme.

### 2. Definitions and Abbreviations

CNE (cable)	— Combined Neutral Earth Cable.
Consumer	— Any person supplied or entitled to be supplied with electricity by the Supply Authority.
Consumer's Supply Point	— Point at which the service cable is terminated on the consumer's premises.
Distributor	— That part of the Supply Authority's distribution sys-

tem to which single or poly-phase service cables are connected; for the purpose of giving supplies to consumers.

Earth Electrode	— Metal rod, buried cable or other conducting object providing an effective connection with the general mass of earth.
Earthing Lead	— A conductor, including any clamp or terminal, by which the connection of the consumer's earth terminal to an Earth Electrode, or to the supplier's earth terminal, is made.
ECC	— Earth Continuity Conductor.
E/L	— Earth Leakage.
High Voltage Equipment Earth	— Combined effect of bonding metal tanks of transformers, switchgear and all metal-work supporting or enclosing HV apparatus, including the sheaths and armouring of HV cables and any continuous earth wires associated with the HV system and connected direct to an Earth Electrode.
HV	— High Voltage.
LV	— Low Voltage.
MEN	— Multiple Earthed Neutral.

PME	— Protective Multiple Earthing.
PNB	— Protective Neutral Bonding.
SNE (cable)	— Separate Neutral Earth Cable.
Supply Authority	— Licenced Supplier of Electricity.
System (i.e. Distribution System, LV System)	— An individual electrical system in which all conductors and apparatus are electrically connected to a common source of voltage.

### 3. Description of Systems

#### Distribution System

##### 3.1 (a) MEN/PME — LV Distribution System

###### MEN/PME

Both MEN and PME share the same technical requirement for the Supply Authority's distribution system in that the neutral is earthed:

- (i) At or near the star point of the transformer
- (ii) At other points on an LV distributor
- (iii) At the remote end of every distributor

##### (b) MEN System — Service Arrangement (Refer Fig. 1)

###### MEN Service

All service connections have an insulated neutral and a separate ECC. The consumer's Earthing Lead is connected to the supplier's earth terminal at the Consumer's Supply Point.

The service neutral and ECC are solidly and separately connected to the Distributor neutral at the tee-off point. The neutral must not be connected to earth at the Consumer's Supply Point. If required by the Supply Authority an Earth Electrode must be installed at the Consumer's Supply Point.

##### (c) PME System — Service Arrangement (Refer Fig. 2)

###### PME Service

Service connections comprise a neutral and live conductor. The consumer's Earthing Lead is connected to the supplier's neutral and to a mandatory Earth Electrode at the Consumer's Supply Point.

##### 3.2 PNB System (Refer Fig. 5)

A system in which —

- (a) A single consumer only is involved, usually supplied from a pole transformer, where it is not desirable to run an ECC to the consumer's premises.
- (b) The neutral is not earthed at the star point on the transformer.
- (c) The neutral is earthed at a single point on the consumer's service connection, usually adjacent to the consumer's premises.

### 4. Technical Requirements for Distribution Systems and Service Connections

#### Distribution Systems

##### 4.1 Distribution Systems

MEN and PME Systems (Refer Figs. 3, 4A, 4B, 6A, 6B & 7)

Distribution equipment associated with transformer substations that are either ground mounted or pole mounted and fed by underground cable or overhead line, with or without an ECC, should be installed, connected and earthed in accordance with the following requirements:—

- (a) Where the resistance to earth of the HV Equipment Earth is 1 ohm or less, it is permissible to earth the LV neutral to the HV Earth Electrode.
- (b) Where the HV Equipment Earth exceeds 1 ohm the LV neutral shall be earthed at a minimum distance of 6 metres from the HV Equipment Earth (i.e. 6 m from the HV electrode/s and also from any earthed metalwork connected thereto). Refer Figs. 7 & 8.
- (c) Notwithstanding the requirements of (a) above, where transformers are associated with HV overhead lines, it is considered good practice to separate the HV and LV Earth Electrodes. All Figs. in this Code relating to this method of distribution, therefore, show a minimum earth separation of 6 m or 1 LV span.
- (d) The overall resistance to earth of the neutral of an LV Distributor or distribution system must not exceed 10 ohms.
- (e) The LV neutral may be connected to other supply neutrals, Earth Electrodes, cable sheaths and armouring and these connections used to obtain the required earthing value of 10 ohms or less specified in Clause (d).
- (f) The neutral of underground and overhead LV Distributors must be earthed at the remote ends of each Distributor.
- (g) Where the overall resistance to earth of the neutral of the distribution system exceeds 10 ohms, the neutral shall be earthed at intermediate positions on the Distributor/s to reduce its resistance to earth to below this limit.
- (h) The cross-sectional area of the neutral of all LV Distributors must not be less than that of a phase conductor.
- (i) No circuit breakers, isolators, fuses, switches or removable links shall be installed in the neutral between the transformer star point and the remote end of any LV Distributor or service connection.
- (j) All metallic sheathing and armouring of cables and all metalwork, associated with meter cabinets, fuse pillars, etc., supporting or enclosing LV cables shall be bonded to the Distributor neutral conductor.
- (k) Where an SNE cable is part of a MEN or PME system, the armouring and/or metallic sheath and any ECC shall be bonded to the neutral at the supply end of the cable.
- (l) To ensure the integrity of the neutral, it is recommended that all connections and joints on or to overhead line conductors be made by compression fittings or, alternatively double bolted connectors.
- (m) MEN or PME may be applied to any single LV Distributor without alterations to other LV Distributors supplied from the same transformer.

##### 4.2 Protective Neutral Bonding (PNB) System

Since the neutral is earthed at one point only, the question of multiple earthing does not arise and there is, therefore, no necessity to meet the MEN/PME technical requirements.

##### 4.3 Service Connections

###### MEN Service Connection

##### 4.3.1 MEN System (Refer Figs. 3, 4A and 6A)

The following conditions apply to consumers' service connections as well as service connections to traffic signals, road signs, street lighting and other power-consuming equipment installed in public places:—

- (a) All service connections must be by means of cable with an insulated phase, an insulated neutral conductor and an ECC.
- (b) A single phase service connection comprises a live, a neutral and an ECC.

- (c) A polyphase service connection comprises two or three phase conductors, a neutral and an ECC.
- (d) The service neutral and ECC must be solidly and separately connected to the Distributor neutral at the tee-off point.
- (e) The consumer's Earthing Lead is connected to the Supply Authority's earth terminal which is in turn connected to the ECC in the service cable at the Consumer's Supply Point.
- (f) The neutral must not be connected to earth at the Consumer's Supply Point.
- (g) If required by the Supply Authority, an Earth Electrode must be installed at the Consumer's Supply Point.
- (h) In a service connection to traffic signals, street lights and other power-consuming equipment installed in public places, such equipment is earthed to the ECC of the service connection.

#### 4.3.2 PME System (Refer Figs. 4B & 6B)

##### PME Service Connection

- (a) All service connections must be by means of a cable with an insulated phase and an insulated neutral conductor.
- (b) A single phase service comprises a live conductor and a neutral.
- (c) A polyphase service connection comprises two or three phase conductors and a neutral.
- (d) The consumer's Earthing Lead is connected to the supplier's neutral and to a mandatory Earth Electrode at the Consumer's Supply Point.
- (e) A label must be attached at the Consumer's Supply Point on his premises indicating that the installation is part of a PME system.

**NOTE** It is not recommended that the PME system be applied to supply traffic signals, street signs or other power-consuming equipment installed in public places, because the PME system is inherently unsafe under "broken-neutral" conditions.

- 5. APPENDIX A:  
SIZE AND TYPE OF EARTH CONNECTIONS.
- 6. APPENDIX B:  
GENERAL RECOMMENDATIONS ON THE PRACTICAL INSTALLATION ON EARTH ELECTRODES.
- 7. APPENDIX C:  
CHOICE OF SYSTEM MEN/PME.
- W. BARNARD, CHAIRMAN EARTHING SUBCOMMITTEE

#### APPENDIX A

##### SIZE AND TYPE OF EARTH CONNECTIONS

#### 1. Step-down Transformers and Associated Metalwork

The tank and associated metalwork of all step-down transformers should be connected to earth by means of a copper Earthing Lead of minimum cross-sectional area of 70 mm<sup>2</sup>. The connection between neutral, the earth bar and the Earth Electrode should be of copper, minimum size 70 mm<sup>2</sup>. Where the possibility exists of a flashover occurring under fault conditions between the High Voltage Earthing Lead and earthed metal in its proximity, it is recommended that the High Voltage Earthing Lead be insulated.

#### 2. Low Voltage Distribution Systems

- 2.1 The existing principles and practices outlined in SABS 0142-1978: Code of Practice for the Wiring of Premises: Section 4.6 EARTHING should be adhered to wherever possible.
- 2.2 Where the neutral conductor of an LV Distributor is connected to an Earth Electrode, earth bar, ECC, lead

sheath and armouring cable or the neutral conductor of another Distributor, an Earthing Lead of minimum cross-sectional area of 50 mm<sup>2</sup> copper or 95 mm<sup>2</sup> aluminium should be used.

#### 3. Service Connections and Supplies to Street Lighting, Traffic Signals and other Street Furniture

- 3.1 The existing principles and practices outlined in SABS 0142-1978: Code of Practice for the Wiring of Premises: Section 4.6 EARTHING should be adhered to wherever possible.
- 3.2 In every case, the Earthing Lead should be of copper or aluminium with current-carrying capacity not less than the neutral conductor of the service or supply cable.
- 3.3 In no case should the cross-sectional area of the Earthing Lead be less than 6 mm<sup>2</sup> copper or 10 mm<sup>2</sup> aluminium.

#### 4. General

Earthing Leads should be as short as possible, and secured and protected against damage, deterioration and loss.

#### APPENDIX B

##### General Recommendations on the Practical Installation of Earth Electrodes

#### 1. Requirements of an Effective Earth

- 1.1 An effective earth must prevent dangerous over-voltages arising between metallic structures, frames, supports or enclosures of electrical equipment and the ground during fault conditions.
- 1.2 An effective earth must be able to permit fault currents of sufficient magnitude to flow so as to operate protective devices to isolate the fault before damage can occur.
- 1.3 The ohmic resistance of an effective earth must be low enough to ensure that the step potential on the ground in the vicinity of the earthing point is within safe limits under fault conditions i.e. a voltage gradient not exceeding 40 volts per metre for fault durations exceeding 1 second.

#### 2. Types of Earth Electrodes

Three types of Earth Electrodes are suitable

- viz. 2.1 Trench Earths
- 2.2 Spike Earths
- 2.3 Foundation Earths

#### 2.1 Trench Earths

Comprise a bare copper or galvanised iron conductor laid at a minimum of 500 mm below ground level, usually when underground cables are installed. This type of Earth Electrode provides a relatively large contact area between electrode and surrounding ground, makes contact with a variety of types of soil and soils of varying moisture content on route and is economical to install.

#### 2.2 Spike Earths

Comprise rods of bare copper, copper-coated steel, stainless or galvanised steel designed for the purpose of penetrating ground to depths of up to several metres. A low resistance earth may sometimes be obtained by driving multiple spikes at some distance from each other in order to provide parallel paths. In hard or rocky ground, it is usually necessary to drill holes into which earth spikes are inserted and then packed with soft soil.

#### 2.3 Foundation Earths

Comprise bare copper or galvanised iron conductors laid under the foundations of buildings, minisubs, concrete roots of distribution pillars, bases of wooden,

concrete or steel poles and structures. Because soil under foundations usually retains moisture, foundation earths are located to take advantage of this fact drill holes into which earth spikes are inserted and cal to install.

### 3. Materials for Earth Electrodes

3.1 Bare copper, either in stranded, strip or rod form, is considered the most suitable general purpose material for Earth Electrodes. Its main disadvantages is its cost and susceptibility to theft.

3.2 Bare galvanised iron and steel, either in stranded, strip or rod form, has a satisfactory record of survival in non-aggressive soils and is more economical than copper.

3.3 Bare aluminium is unsuitable as electrode material.

### 4. General

Because galvanised ferrous metals corrode sacrificially to copper, galvanised iron and steel electrodes should not be buried in close proximity to bare copper.



*"The three persons responsible for the AMEU Code of Practice on the Earthing of the Neutral in Low Voltage Distribution Systems J.L.R. V. A. Raynal, Convener of the Organizing Committee of the Multiple Neutral Earthing Workshop of the S.A. Institute of Electrical Engineers, R. G. Dean, Principle Engineer, Planning, Durban Corporation, and W. Barnard, Chairman of the AMEU Sub-committee: Earthing. Much of the work in drawing up the AMEU Code of Practice was undertaken by Mr. Raynal, assisted by Mr. Dean."*

## APPENDIX C

### Choice of System MEN/PME

#### 1. MEN

##### 1.1 Advantages

- If a break occurs in the service neutral all bonded metalwork and appliances will remain at the same potential as the distributor neutral.
- An E/L device is less affected by the desensitising short circuited turn effect created by a fault on the consumer's neutral, due to the impedance of the ECC and service cable neutral being part of the "shorted turn" circuit.

##### 1.2 Disadvantages

The continuity of the service cable ECC is not self monitoring, i.e. in the event of a break in the ECC the consumer will be left without an effective earth for an indefinite period.

There is, therefore, merit in recommending that an Earth Electrode is installed at the Consumer's Supply Point (earthing resistivity values permitting) to ensure the operation of an E/L device.

#### 2. PME

##### 2.1 Advantages

- Provides a continuously monitored earthing system, i.e. if a consumer is receiving a stable LV supply an effective earth is known to exist.

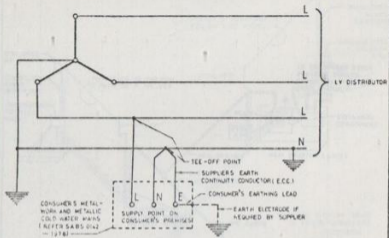
##### 2.2 Disadvantages

- In the event of an open circuited service neutral, voltage gradients can occur in the vicinity of consumer's premises.  
The minimising of any possible hazards arising from this is dependent on efficient earth bonding.
- The desensitising short circuited turn effect of a fault on the consumer's neutral on the E/L device is more pronounced than in the MEN system, due to the shorter loop circuit.
- It is necessary to place a PME notice adjacent to the Consumer's Supply Point advising that a PME System is in operation.
- It is mandatory to install an Earth Electrode at the Consumer's Supply Point.

MULTIPLE EARTHED NEUTRAL (M.E.N.) SYSTEM

**FIG. 1**

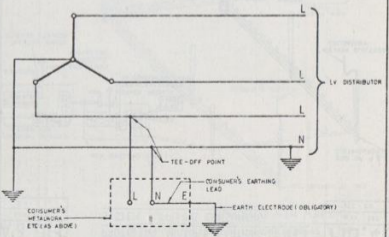
MAY 1980  
JCC-EG



PROTECTIVE MULTIPLE EARTHING (P.M.E.) SYSTEM

**FIG. 2**

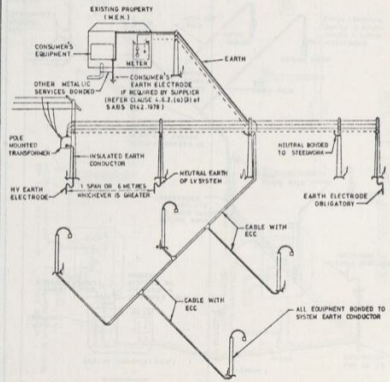
MAY 1980



M.E.N. SYSTEM SUPPLYING CONSUMERS AND STREET LIGHTING

**FIG. 3**

JUNE 1980  
JCC-ED

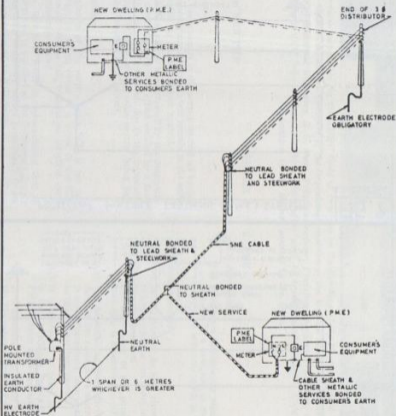


PROTECTIVE MULTIPLE EARTHING (P.M.E.)  
SYSTEM SUPPLYING CONSUMERS

FIG. 4B

MAY 1980

JCC - ED

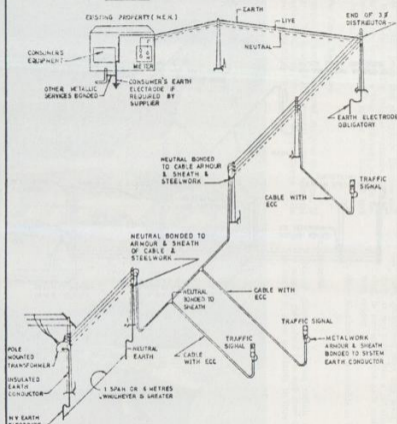


MULTIPLE EARTHED NEUTRAL (M.E.N.)  
SYSTEM SUPPLYING CONSUMERS,  
TRAFFIC SIGNALS & STREET  
LIGHTING

FIG. 4A

JUNE 1980

J.C.C. - F.D.

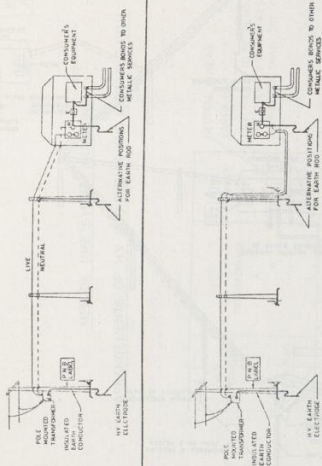




PROTECTIVE NEUTRAL BONDING (PNB)

FIG. 5

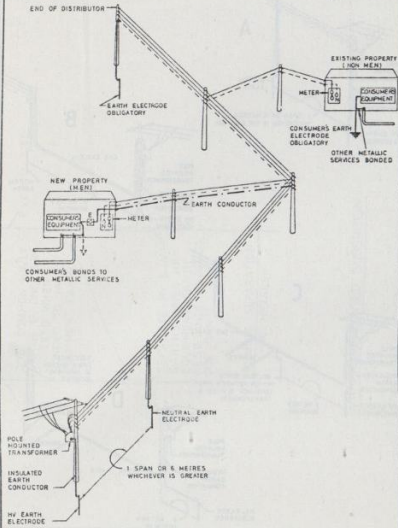
MAY 1980  
J.E.C.-ED



MEN. SYSTEM APPLIED TO EXISTING NON-MEN AND NEW MEN CONSUMERS

FIG. 6 A

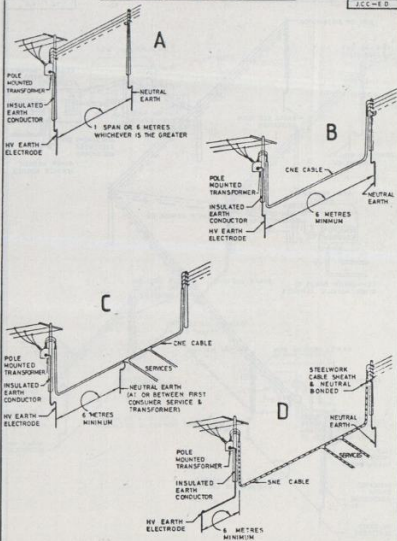
MAY 1980  
J.E.C.-ED



M.E.N. or P.M.E. SYSTEM INDICATING ARRANGEMENTS  
OF HV EQUIPMENT AND NEUTRAL EARTH

FIG. 7

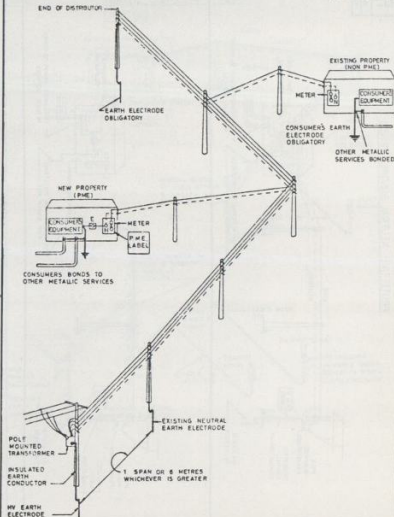
MAY 1960  
J.C.C.-E.D.



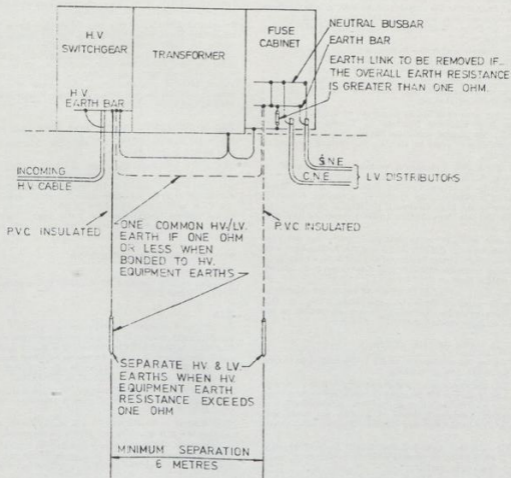
P.M.E. SYSTEM APPLIED TO NON-P.M.E.  
AND NEW P.M.E. CONSUMERS

FIG. 6 B

MAY 1960  
J.C.C.-E.D.



MEN OR PME SYSTEM INDICATING  
ARRANGEMENTS OF H.V. EQUIPMENTS AND NEUTRAL EARTH



GROUND MOUNTED SUBSTATION

## MR. W. BARNARD: JOHANNESBURG

Mr. President, I am not planning to discuss this in any detail, because we have been discussing it for 25 years as far as I know and you will recall that, a year ago at Welkom, I had issued at the Technical Meeting a draft code and we agree we would try this out in practice over a 12 month period. The intention is to propose it for adoption it today as an AMEU Code of Practice. The SABS have undertaken to redraft the Code as an SABS Code of Practice in due course and that, to me, means within the next ten years.

The changes that you will see in this Code of Practice are mainly editorial. There are no major changes and I would like to express my appreciation publicly to Mr. Dean of Mr. Fraser's staff, who put in a tremendous amount of work and I think he added very considerably to the final product. The main changes that he suggested were to the definitions and abbreviations. It has not been translated at this stage. Thank you.

## MR. J. C. VAN ALPHEN: SABS

Mr. President, in 1979 the SABS tabled a first draft of a Code of Practice for the earthing of the neutral in low voltage distribution systems, which was based on the work done by Mr. R. G. Dean, Chief Engineer, Planning, of the Durban Corporation.

It soon transpired that the Bureau would have to delay this worthy and much needed project and in 1979 the AMEU empowered your President Elect, Mr. W. Barnard, to lead an AMEU sub-committee in drafting an AMEU Code of Practice on this subject. This draft was tabled at the 1980 AMEU Technical Meeting.

During my term of office as Chairman of the Power Group of the South African Institute of Electrical Engineers (SAIEE), Mr. Raynal was asked by the Power Group to set up a workshop in order to ventilate the various opinions on this subject.

On 24 March 1981 a successful workshop was held at Megawattpark, Sandton. A report on the deliberations of this workshop is in preparation for publication in the Transactions of the Institute. In April 1981, a drafting committee consisting of Mr. Dean (Durban), Mr. Raynal (Johannesburg, retired) and Mr. van Alphen (SABS), amended the 1980 AMEU draft.

The second draft, is the product of effective and swift co-ordination between AMEU, SABS and SAIEE, and, as Past Chairman of the Power Section of the Institute, I have great pleasure in recommending it to your Convention to be adopted as an AMEU Code of Practice.

With the other hat on as Chairman of the SABS Committee for the Earthing of Electrical Installations, I am sure that the Bureau would be amenable to re-open its project on low voltage earthing should the AMEU so wish.

## THE EARTHING OF THE NEUTRAL

Table 1 gives the development of the SABS project on neutral earthing of low voltage systems.

Block 1 is the common method of earthing in many installations. The provisions for an earth electrode are to be covered in a Code of Practice which is now in an advanced stage of preparation. The requirements of bonding the consumer's earthing lead to the earthing electrode are covered in SABS 0142.

Blocks 2 - 4 are covered in the AMEU Code of Practice. Block 2 PNB needs no further discussion as it is a special case of single point earthing.

Blocks 3 and 4 are variations of consumer's connections onto a multiple earthed system of the supply authority. The latter system will be designated an ME system.

## THE ME SYSTEM

The ME system has strong economic advantages and permits the use of the CNE cable. It is a cable that combines the function of a neutral and ECC into a wave form conductor. The wave form again permits connections to be made without breaking the integrity of the combined neutral and earth conductors, an advantageous requirement for ME systems. The ME system also helps in overcoming earthing problems.

The AMEU Code requires a maximum of 10... earth resistance of an ME system. In the UK this requirement has been raised to 20... which simplifies the system.

For example, with a 100 A fuse in the HV protection of an 11 kV system, in order to ensure a critical cut out during an HV to LV winding fault, the earth resistance of the LV neutral should not exceed:-

$$\frac{11\ 000}{\sqrt{3 \cdot 100}} \approx 60\ \Omega$$

Hence, with a factor of safety of 2, 30... would be sufficient and 20... fully acceptable.

## THE SUPPLY AUTHORITY'S OBLIGATION

Although the ME system helps in overcoming earthing problems, it should be made clear that ME IS NOT MEANT FOR THE SUPPLY AUTHORITY TO OFF-LOAD HIS EARTHING PROBLEMS ONTO HIS CONSUMERS.

Assuming the 10... requirement to be in force, this means that a distributor should have an earth resistance of 10... or less before consumers are connected.

In existing distributors this may be checked by in turn disconnecting each earth electrode on the distributor and measuring its earth resistance and thereafter calculating the combined earth resistance of all earth electrodes on the distributor. In this calculation, the contribution in lowering the earth resistance by supply neutrals of other connected distributors, cable sheaths armouring, metal work of meter cabinets, fuse pillars etc., all belonging to the Supply Authority's system, should be included.

## THE CONSUMER'S CONNECTIONS, MEN AND PME

Fig. 1 and 2 of the AMEU Code show the consumer's connection by either MEN or PME.

During the workshops there was a strong feeling that the service connection to the Tee-off on the distributor the Neutral and ECC should each be separately connected to the distributor neutral. An error made in certain systems is to use MEN and at the same time to bond the earth terminal to the neutral terminal on the meter board. This in fact makes the consumer's connection PME and should be treated as such.

## BROKEN NEUTRAL CONDITIONS

### PME:

A broken neutral means a broken ECC but, a sound neutral means a sound ECC.

### MEN:

An ECC in a consumer's service connection MAY be sound, but this is not necessarily so as its condition is not monitored. Consensus in the SAIEE workshops was that a broken neutral condition is very rare and would be reported immediately. A broken ECC in an MEN system is also very rare, but connections with a HIGH CONTACT RESISTANCE are much more frequent (even though still of a very low incidence).

The latter is especially prevalent in a Tee-off on an Aluminium O/H distributor.

There appear to be a demand for a proper design of a line tap that will give a lasting low resistance connection.

In order to minimize the danger of a broken neutral or ECC, the Code advocates the use of a cable (concentric or split concentric for all service connections, even when overhead.

## THE CONSUMER'S EARTH ELECTRODE

The requirement of a consumer to provide an earth electrode is not dealt with in the Code other than in summary statements.

Appendix B gives some information without being conclusive as to why, how, and to what resistance limit an electrode should be provided.

Unless the supply authority installs the consumer's earth electrode, the supply authority should not view the consumer's earth electrode as a convenient means of off-loading his earthing problems. The consumer's earthing system (whether

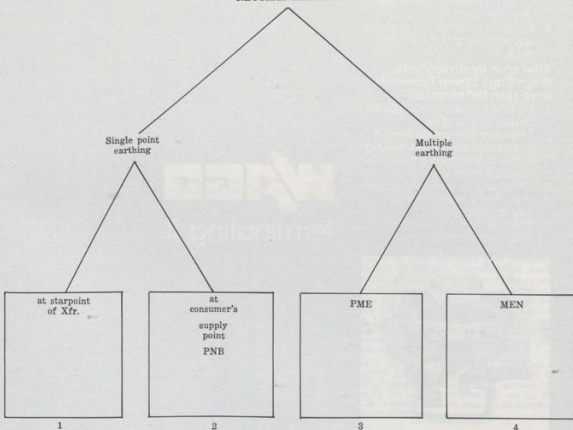
or not this includes an earth electrode) should be good enough to make the consumer's earth leakage relay do operate.

It must, however, be bad enough to safeguard the bonds to the earthing electrode in accordance with the Wiring Regulations. The latter are liable to be too light should the consumer have a low earth resistance and the supply authority's earth be deficient.

#### MR. V. MACDONALD: ECA

Mr. President, Mr. von Ahlfen's comments in his report distressed me a little when I read at the end that he felt that this Committee had served its purpose but, with a little bit of persuasion and I am pleased to hear him say that we should reconvene the Committee. Mr. Chairman, we, the ECA, believe that there is a tremendous amount that we could do together.

### NEUTRAL EARTHING



#### MR. D. H. FRASER: PRESIDENT

Thank you Mr. van Alphen. I think that we have to avoid further discussion on this subject at this stage, and decide whether we are to continue with the committee reports at the total expense of the Members Forum. Having consulted my colleague on the right we have decided that discussion of

the Committee Reports has a higher priority than the Forum and the Forum Session will have to be held over to the next Technical Meeting. The Code of Practice for multiple earthing of the neutral on LV distribution systems is now in a form where it is useable by members of the AMEU. A request will be made to the SABS to put it into their standard Code of Practice format, but we have a document which in the meantime can serve as a standard for Municipalities.

# soweto

an electrifying problem

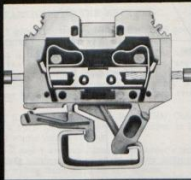
The electrification of 100,000 Soweto homes is a vast undertaking and the choice of terminal blocks was one of the many problems which had to be overcome. It was important that the terminal blocks chosen would be:-

1. Quick to install
2. Immune to vibration due to their location in cubicles on the roadside.
3. Able to maintain contact integrity despite being installed in vast numbers by a relatively unskilled work force.
4. Capable of achieving all these advantages at a competitive price.

**After an in depth analysis, Wago Cage Clamp Terminals were selected because:-**

1. No wire termination is required. Simply strip and fix.
2. The cage clamp maintains a constant pressure eliminating loose connections either by vibration or heat cycling.
3. There are no screws to loosen or tighten yielding a time saving of up to 60%.
4. Wago terminal blocks are inherently less expensive.

**WAGO**<sup>®</sup>  
terminating it.



**Bowthorpe-Hellermann-Deutsch**  
Johannesburg: PO Box 27063, Benrose 2011. Tel. 614-1111  
Durban: PO Box 10124, Marine Parade 4056. Tel. 37-5594/5  
Cape Town: PO Box 6646, Roggebaai 8012. Tel. 43-0626

**(Pty) Ltd**



# REPORT ON THE SOUTH AFRICAN ELECTROLYTIC CORROSION MAIN COMMITTEE

This report covers the activities of the South African Electrolytic Corrosion Main Committee for the two years 1979 and 1980.

Meetings of the Main Committee were held on 26 September 1979 and 24 September 1980, under the chairmanship of Mr. L. H. James of the Rand Water Board.

At the 1979 committee meeting, reports from various regional field committees were considered.

In Natal there had been an apparent increase in incidence of corrosion in the area. Complaints from domestic consumers frequently pointed to trouble on major services.

In the Cape Northern region, investigations were in progress to assess the implications of 50 kV AC traction currents on the Sishen-Saldanha rail link.

In the Cape Western region investigations were being conducted prior to two sections of railway being electrified. A conductive aggregate for concrete was being tested. SAR comments were that new lines constructed on concrete sleepers tended to have reduced leakage of current to earth.

At the 1980 committee meeting, reports were considered from the regional field committees of Cape Northern, Cape Western, Natal and Witwatersrand.

In the Cape Northern region, Mr. Macey pointed out that no corrosion had been noticed on ESCOM's towers along the Sishen-Saldanha SAR line. The position is, however, being watched closely.

Mr. Gilmour, from the Cape Western region, reported that electrolytic corrosion in the Western Cape is under control. Following a discussion regarding the boundaries of regional field committees, it was confirmed that, if any problems arose in the Eastern Transvaal, these be brought to the notice of the Witwatersrand Regional Field Committee.

Mr. J. van Rooy of the SAR was appointed by the Main Committee to be the representative on the SABS committee dealing with the Code of Practice for Earthing under project nos. 0791/5029 and 0791/5030.

The Main Committee agreed, after discussion, that the new Code of Practice SABS 0121/1977 would supersede Code of Practice SAECC/1. This concerns track crossings and appropriate cathodic protection.

The Apollo earthing system was discussed. Mr. Raynham of ESCOM reported that the two DC lines to Caborra Bassa normally operate in the bi-polar mode with the current in the two lines fairly well balanced.

When trouble is experienced on one line, the other line is switched to mono-polar operation where the current is passed via earth electrodes for a maximum of three days before the polarity is reversed. This mode of operation is, however, not favoured and at this stage the stipulation from the SAR to limit mono-polar operation to 1 800 amps is observed. This stipulation was endorsed by the meeting because of the difficulties experienced by owners of underground services in the area.

A copy of a drawing, showing SAR electrification projects up to December 1979, was sent to each of the AMEU regional representatives to assist them in determining which Local Authorities in their respective areas may be affected by electrified tracks.

A. H. L. FORTMANN, Representative/Verteenwoordiger

# VERSLAG OOR DIE SUID-AFRIKAANSE ELEKTROLITIESE KORROSIE HOOFKOMITEE

Hierdie verslag dek die bedrywighede van die Suid-Afrikaanse Elektrolitiese Korrosie Hoofkomitee vir die twee jaar 1979 en 1980.

Vergaderings van die Hoofkomitee is op 26 September 1979 en 24 September 1980 onder voorsitterskap van Mr. L. H. James van die Rand Waterraad gehou.

Tydens die 1979-komitee vergadering, was die verslae van die verskillende streeksveldkomitees oorweeg.

In Natal was daar 'n blykbare vermeerdering in die voorkomsyfer van korrosie. Klages van huisverbruikers het dikwels op moeilikhede by groter dienste gelei.

In die Kaap (noordelike streek) was ondersoek gedoen om die invloed van 50 kV GS traksiestroom op die Sishen-Saldanha spoorverbinding vas te stel.

Voordat twee seksies van die spoorlyn in die Kaap (westelike streek) ge-elektrofiseer was, was ondersoek ingestel. Die gemiddelde geleidingsvermoë van beton is getoets. Die S.A. Spoorweë se opmerkings was dat nuwe spoorlyne met beton-dwarslers die neiging toon om die stroomlekkasie na aard te verminder.

Verslae van die streeksveldkomitees van die Kaap (noordelike streek), Kaap (westelike streek), Natal en Witwatersrand, is by die 1980 komitee vergadering oorweeg.

Mnr. Macey het daarop gewys dat geen korrosie by EVKOM se torings langs die Sishen-Saldanha spoorlyn in die Kaap (noordelike streek) opgemerk is nie. Die saak word egter fyn dopgehou.

Mnr. Gilmour van die Kaap (westelike streek) het gerapporteer dat elektrolitiese korrosie daar onder beheer is.

Na bespreking in verband met die grensperke van die streeksveldkomitees is dit bevestig dat, indien enige moeilikhede in die Oos-Transvaal opduik, die saak onder die aandag van die Witwatersrand Streeksveldkomitee gebring moet word.

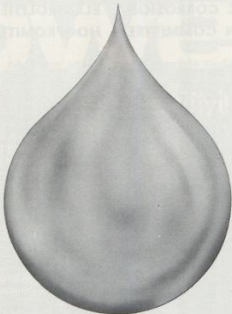
Mnr. J. van Rooy, van die S.A. Spoorweë is deur die Hoofkomitee as verteenwoordiger op die SABS-komitee, wat met die Gebruikskode vir Aarding onder projek nommers 0791/5029 en 0791/5030 handel, aangestel.

Die Hoofkomitee het ook na bespreking ooreengekom dat die nuwe Gebruikskode, SABS 0121/1977 die Gebruikskode SAECC/1 sal vervang. Dit behels spoor kruisings en toepaslike katodiese beskerming.

Die Apollo aardingstelsel is bespreek. Mnr. Raynham van EVKOM het gemeld dat die twee gelykstromige geleidings na Caborra-Bassa normaalweg in die tweepolige stelsel werk met die stroom in die twee geleidings goed gebalanseer.

Indien moeilikheid op een geleiding ondervind word, word die ander geleiding na die enkelpolige-werking, waar die stroom deur middel van aard-elektrodes gelei word, vir 'n maksimum van drie dae oorgeskakel. Hierdie werksmetode word egter nie voorgestaan nie en word tans binne die S.A. Spoorweë se beperking van 1 800 Amp. vir enkelpolige-werking gehou. Hierdie beperking was deur die vergadering onderskryf omdat baie moeilikheid deur elenaars van ondergrondse dienste ondervind word.

'n Afdruk van 'n tekening waarop die S.A. Spoorweë se elektifikasie projekte tot op Desember 1979 aangedui word, is aan elke VME0 streeksvertegenwoordiger gestuur. Dit kan van nut wees by die bepaling van watter van die Plaaslike Besture in hulle betrokke gebiede deur die elektifikasie van spoorlyne geraak mag word.

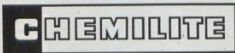


## save the drops and you won't get into deep water

With sky-rocketing costs of equipment and resources, it is vital to extend the life of equipment and maximize the use of production commodities by extracting every re-usable drop!

Chemilite are Engineering Design Consultants, specialising in the manufacture, installation and servicing of oil purification, water treatment and fluid movement equipment.

Chemilite equipment and know-how can save you money by eliminating your wastage.



JOHANNESBURG: 14 Sandberg Street, Denver, Tel. 616-1313.  
BULAWAYO: 7 Bellevue Road, Belmont, Tel. 7-0098.  
CAPE TOWN: 30 Selsdon Road, Parow, Tel. 93-2197.  
DURBAN: 7 Schenk Road, Pinetown, Tel. 71-1347.  
MIDDELBURG: TVL 2, 5th Street, Middelburg, Tel. 4979.  
PORT ELIZABETH: 143 Commercial Road, Sidwell, Tel. 41-3304.  
USA: 506 Rosamond, Houston, Texas, 77076, Tel. (713) 695-5944.



# CAPE WESTERN ELECTROLYTIC CORROSION REGIONAL FIELD COMMITTEE REPORT ON ACTIVITIES 1979/1980

Six meetings of the Cape Western Electrolytic Corrosion Regional Field Committee were held during the period under review under the chairmanship of Mr. R. R. Gilmour of the City of Cape Town's Electricity Department.

Meetings were well attended by members representing the following organisations:

*S.A. Railways Administration*  
*Cape Town City Council*  
*ESCOM*  
*Cape Gas Limited*  
*Department of Posts and Telecommunications*  
*Oil Industry Corrosion Control Group*  
*Cape Provincial Administration*  
*The Association of Municipal Electricity Undertakings (AMEU)*

Routine tests on underground services in the region were carried out periodically and the necessary remedial action was taken by the organisations concerned.

The installation of a new water pipeline between Rivier-sonderend and Blackheath commenced during the period under review and in order to assist in the planning of any protective system that may become necessary to prevent corrosion an extensive oil resistivity survey was carried out by the City of Cape Town.

Due to the extension of the d.c. electrified railway system via Kensington to Bellville and to the new Cape Town harbour and to Mitchells Plain, appropriate tests were carried on adjacent or nearby underground services. To date there have been no indications of any stray currents or corrosion in the areas concerned.

The a.c. electrified railway from Sishen to Saldanha has been deemed to terminate in the region embraced by this regional committee. This accordingly aroused considerable interest in possible corrosion by alternating currents and all aspects of this matter were discussed at length during meetings of the committee. It has been accepted that any electrolytic corrosion that could arise from stray alternating currents by leakage, or for example by residual current in electricity consumers earthing electrodes which are connected to the supply neutral conductor, takes place at a considerably slower rate than with equivalent direct currents. Studies have indicated that so far there is no cause for alarm in this regard, either in this country or elsewhere.

The question of earthing in relation to corrosion continued to be discussed.

Attention was drawn to the replacement of wood sleepers by concrete sleepers on certain sections of the Cape Peninsula railway system and in view of the interest shown in the electrical properties of concrete, resistivity tests were carried out on specimens of each type of sleeper with the kind co-operation of the South African Railways. The conclusion drawn from these tests was that concrete is a better material than wood for reducing stray earth currents.

It was reported to the committee for information that cathodic protection was being applied at the upper and lower reservoirs associated with the City of Cape Town's Steenbras hydro-electric pumped-storage scheme to supplement protection provided by coatings applied to the control gates.

Minutes of meetings of the Main Committee, which were attended by the Chairman, and of other regional committees were received and discussed resulting again in the exchange of useful information.

Codes of Practice were also discussed and it was reported that the South African Bureau of Standards (SABS) were handling these now.

# WES-KAAPLANDSE BUITESTREEK- KOMITEE INSAKE ELEKTROLITIESE KORROSIE VERSLAG OOR BEDRYGWIGHEDE 1979/1980

Die Wes-Kaaplandse Buitestreekkomitee Insaake Elektrolitiese Korrosie het ses vergaderings gebou gedurende die onderhawige tydperk onder die voorsitterskap van mnr. R. R. Gilmour van die Kaapstadse Elektriese departement.

Vergaderings is goed deur Komiteede, wat die volgende organisasies verteenwoordig, bygewoon:

*S.A. Spoorweë-Administrasie*  
*Die Stadsraad van Kaapstad*  
*EVKOM*  
*Cape Gas Beperk*  
*Departement van Pos- en Telekommunikasiewese*  
*Die Verweringsbeheergroep van die Olienywerheid*  
*Die Kaapse Provinsiale Administrasie*  
*Die Vereniging van Munisipale Elektriese-ondernemings (VMEG)*

Routine-toetse is periodiek op ondergrondse dienste in die gebied uitgevoer en verbeterings is aan die hand gedoen deur die betrokke organisasies.

Die aanbring van 'n nuwe waterpyplyn vanaf Rivier-sonderend na Blackheath is in aanvang geneem gedurende die tydperk en om rede met die beplanning van 'n beveiligingsstelsel te help indien benodig om verwerking te verhoed, is 'n uitgebreide ondersoek van die grondresistiwiteit uitgevoer deur die Stad Kaapstad.

As gevolg van die uitbreiding van die gelykstroom-elektrifiseerde spoorwegstelsel via Kensington na Bellville, na die nuwe Kaapstadse hawe en na Mitchells Plain, is gepaste toetse uitgevoer op naaseleë of nabye ondergrondse dienste. Tot dusver is daar nog geen aanwysings van enige swerfstromes of verwerking in die betrokke gebied nie.

Die wisselstroom-elektrifiseerde spoorlyn vanaf Sishen na Saldanha na oordeel word beskou te eindig in die gebied onder die toesig van hierdie streekkomitee. Dit het gevolglik ontsaglike belangstelling gewek in die moontlike verwerking deur wisselstroom en alle aspekte van hierdie saak is doelig bespreek by die vergaderings van die komitee. Dit word aangeneem dat enige elektrolitiese verwerking wat mag ontstaan deur swerfswisselstroom deur lekkasie of byvoorbeeld deur stroomres in die aardpene van elektriese verbruikers wat verbind is aan die voorsiener se nulgeleier, teen 'n baie stadiger tempo plaasvind as deur ekwivalente gelykstromes. Daar is egter bepaal dat daar nie rede vir kommer in hierdie opsig is in hierdie land of elders is nie.

Die vraag van aarding in verband met verwerking is steeds nog bespreek.

Aandag is gevestig op die vervanging van houtdwaarslêers deur betondwaarslêers op sekere skakels van die spoorlynstelsel in die Kaapse Skiereiland en as gevolg van die belangstelling getoon in die elektriese eienskappe van beton, is resistiwiteitstoetse op monsters van hierdie tipe dwaarslêers uitgevoer met die goeie samewerking van die Suid-Afrikaanse Spoorweë. Die gevolgtrekking bereik as gevolg van hierdie toetse is dat beton 'n beter materiaal as hout is om swerf-aardstrome te verminder.

Dit is aan die komitee vir inligting gemeld dat katodiese beskerming aangewend word by die boonste en onderste opgaardamme verbode aan die Kaapstadse Steenbras-hidro-elektriese pompopgaarskema om die beveiliging versak deur aangewende deklare aan die kontroleluisie, aan te vul.

Die notule van die vergaderings van die Hoofkomitee, wat deur die Voorsitter bygewoon is, en van ander streekkomitees, is ontvang en bespreek wat gelei het tot die uitruiling van nuttige inligting.

Gebruikskodes is ook bespreek en dit is gemeld dat die Suid-Afrikaanse Bureau van Standaarde (SABS) dié kodes nou onder hande neem.

# BEWAAR ONS OLIE!

Die Republiek van Suid-Afrika het die hulp van u industrie nodig vir die terugwinning van 'n strategiese bron. Olie!

Chemico, die grootste herraffineerder kan in hierdie behoefte voorsien.

U, die industrialis kan Suid-Afrika en uself miljoene Rande bespaar deur u gebruikte smeerolie te laat herraffineer.

Telefoon: Rand (011) 762 2481 Durban (031) 48 2341

Port Elizabeth (041) 41 2196 Kaapstad (021) 55 2693 Oos-Londen (0431) 20 770

*Bewaar ons land se bronne*

# CHEMICO

*Conserve the resources of our land*

# CONSERVE OUR OIL!

The Republic of South Africa needs the help of your industry for the recovery of a strategic resource. Oil!

Chemico, the largest re-refiner, serves this function.

You, the industrialist can save South Africa and yourself millions of Rand by having your used lubricating oil re-refined.

Telephone: Rand (011) 762 2481 Durban (031) 48 2341

Port Elizabeth (041) 41 2196 Cape Town (021) 55 2693 East London (0431) 20 770

It is evident that electrolytic corrosion in the Western Cape is still under control and that the present frequency of meetings is therefore adequate. Meetings of the regional committee were attended by Messrs. T. Pollock and W. P. Rattey, Town Electrical Engineers of Gordons-Bay and the Strand respectively, on behalf of myself as the AMEU Regional Representative.

Representation of the AMEU on the Cape Western Regional Field Committee is definitely regarded as worthwhile and of considerable value. Members in the region are continuously informed of developments in this sphere and encouraged to submit any corrosion problems experienced by their municipalities to the regional committee for consideration.

D. C. PALSER  
REPRESENTATIVE/VERTEENWOORDIGER

## REPORT ON THE WITWATERSRAND ELECTROLYTIC CORROSION REGIONAL FIELD COMMITTEE

This report covers the activities of the Witwatersrand Electrolytic Corrosion Regional Field Committee for the two years 1979 and 1980.

The following meetings were held during the abovementioned period:—

1. 11 January 1979 (This meeting took place just prior to the 1979 AMEU Convention)
2. 4 July 1979
3. 9 January 1980
4. 2 July 1980

The first meeting scheduled for 1981 was held on 21 January 1981.

The Chairman for all these meetings was Mr. Dou Kotzee of GASCOR and the meetings were generally very well attended.

The committee considered a number of applications for natural drainage bonds and forced drainage bonds — forming an important part of the routine work of this committee.

Rondepoort City Council experienced the failure of two diodes in their drainage bonds, and these were replaced in February 1979.

The Town Council of Standerton experienced corrosion damage to an 11 kV cable that crosses the main Johannesburg-Durban railway track, as well as the SAR products pipeline. This matter was referred to the SAR electrical test laboratory for attention and report.

An attempt was made to update the schedule of AMEU members who should be kept informed of the committee's activities.

A. H. L. FORTMANN, Representative/Verteenwoordiger



Dit is duidelik dat elektrolitiese korrosie in Wes-Kaapland steeds onder beheer is en dat die huidige aantal vergaderings voldoende is. Vergaderings van dié streekcommittee is bygevoeg deur mnr. T. Pollock en W. P. Rattey, die Elektro-egniese Stadsingenieurs van Gordonsbaai en die Strand respektiewelik, namens my as die VMEO-verteenvoordiger.

Verteenwoordiging van die VMEO op die Wes-Kaaplandse Buitestreekcommittee is die moeite werd. Lede in die streek word voortdurend op hoogte gehou van ontwikkelings op die gebied van elektrolitiese korrosie en word aangemoedig om enige korrosieprobleme soos deur hulle munisipaliteite ondervind aan die komitee voor te lê.

## VERSLAG OOR DIE WITWATERSRANDSE ELEKTROLITIESE KORROSIE STREEKVELD- KOMITEE

Hierdie verslag dek die bedrywigheid van die Witwatersrandse Elektrolitiese Korrosie Streeksveldkomitee vir die twee jare 1979 en 1980.

Die onderstaande vergaderings was gedurende die bogenoemde tydperk gehou:—

1. 11 Januarie 1979 (Hierdie vergadering het net vroeër as die VMEO-konferensie van 1979 plaasgevind)
2. 4 Julie 1979
3. 9 Januarie 1980
4. 2 Julie 1980

Die eerste vergadering op die 1981-lys is op 21 Januarie 1981.

Die Voorsitter by al hierdie vergaderings was Mnr. Dou Kotzee van GASCOR en vergaderings was algemeen baie goed bygewoon.

Die komitee het 'n aantal aansoek om natuurlike dreinerings-aansluitings en gedwonge dreineringsaansluitings oorweeg. Dit is 'n belangrike deel van die taak van hierdie komitee.

Die Stadsraad van Roopepoort het onderbreking van twee diodes by hulle dreineeraansluitings ondervind en dit was gedurende Februarie 1979 vervang.

Die Stadsraad van Standerton het skade as gevolg van korrosie van 'n 11 kV-kabel wat die hoofspoorlyn tussen Johannesburg en Durban, sowel as die spoorweg se produktepplyn kruis, opgedoen. Hierdie saak was na die SAS se elektriese toetslaboratorium vir aandag verwys.

'n Poging is aangewend om die lys van VMEO-lede wat op hoogte van die bedrywigheid van hierdie komitee gehou moet word, op datum te bring.

MNR. E. DE C. PRETORIUS; POTCHEFSTROOM

Mnr. die President, ek wil formeel voorstel dat die Uitvoerende Raad oorweging daaraan skenk om by die volgende Tegnieese Vergadering, iemand te kry om 'n referaat te lewer oor elektrolitiese korrosie.

MR. D. H. FRASER; PRESIDENT

Dankie mnr. Pretorius, ons sal dit oorweeg.

# R10 000

# GUARANTEE OF WORK SCHEME

on all electrical installations by ECA members



THE Electrical Contractors' Association (South Africa), offers a "Guarantee of Work" scheme which covers up to R10 000 to customers of any of the Association's member firms. The ECA is the association representing the electrical contracting industry in South Africa — the hundreds of firms, large and small, who do in excess of 80% of the electrical installations in South Africa.

The Association takes considerable pride from the quality of work done by its members, who before they are admitted, must satisfy the Association that they meet the required standards.

The number of complaints are therefore very few — a recommendation in itself of the high standards set by the ECA for member firms.

The "Guarantee of Work" scheme is now an integral part of the code of procedure for handling customer complaints. The scheme applies to all

electrical installation work undertaken by member firms, other than those contracts regulated by standard forms of building contract or sub-contract, which already provide for making good defects.

When a customer feels he has cause for dissatisfaction, the member firm must be given a reasonable opportunity of rectifying any failure or defect. If there is still dissatisfaction or disagreement, a complaint made in writing to the Association and supported by correspondence and other documentation, will be fully investigated.

If conciliatory action fails, an independent arbiter will be appointed. His duty would be to investigate the complaint. If the arbiter finds in favour of the customer, the Association will arrange for the member firm or another member firm, to rectify the work in accordance with the arbiter's findings to you the customer.

**THE ASSOCIATION IS YOUR SAFEGUARD: INSIST ON YOUR CONTRACTOR BEING A MEMBER OF THE ELECTRICAL CONTRACTORS' ASSOCIATION (SOUTH AFRICA).**

*Copies of the full scheme may be obtained from: The Electrical Contractor's Association (SA). HEADOFFICE: 408 Carlton Centre, Von Wielligh Street, P.O. Box 5327, Johannesburg, 2000. Telephones 21-7988/9. BRANCHES: BLOEMFONTEIN: P.O. Box 187, Bloemfontein, 9300. Tel. 81145/6; J. Lubbe. BOLAND: P.O. Box 256, Paarl, 7620, Tel. 21707; W. F. Uys. CAPE TOWN: P.O. Box 4324, Cape Town, 8000, Tel. 21-5339; N. Morris. EAST LONDON: P.O. Box 271, East London, 5200. Tel. 25729/21391; R. Allison. NATAL BRANCH: 407 M.B.A. Building, 598/1 St. Andrews St., Durban, 4000, Tel. 313349/313340; A. J. Williams. PORT ELIZABETH: P.O. Box 411, Port Elizabeth, 6000, Tel. 54-1246; C. Parmenter. TRANSVAAL BRANCH: P.O. Box 5327, Suite 406, Carlton Centre, Johannesburg, 2000, Tel. 21-7988/9; J. C. Baker.*

# REPORT OF THE AMEU/ECA LIAISON SUB-COMMITTEE

## 1. Introduction

The Electrical Contractors Association (SA) submitted a request to the AMEU Executive Council during October 1978 that a Liaison Committee be established with the object of discussing the implementation of the new SABS Code of Practice for the Wiring of Premises as well as other matters of mutual concern as and when these arose. The Executive Council agreed to this request and subsequently a Liaison Subcommittee was formed with the AMEU being represented by Mr. J. K. von Ahlften as the Convenor, Mr. D. H. Fraser and Mr. E. de C. Pretorius. The Department of Manpower Utilisation was also asked to attend meetings in an advisory capacity.

## 2. Work of the Subcommittee

This Subcommittee met for the first time during February 1979 and it was subsequently reported that the Executive Council of the AMEU had in fact resolved to request all municipal supply authorities to adopt the new SABS Wiring Code as from January 1980.

The legal problems that will be encountered in adopting this Code as part of the Standard Electricity By-laws of local authorities in substitution of the old Standard Regulations for the Wiring of Premises are only too well known.

Misleading and irresponsible statements have appeared repeatedly in print to the effect that the majority of municipal supply authorities have refused to adopt the new SABS Wiring Code, but the facts are that the whole problem hinges around the Standards Act which requires an SABS Code of Practice to be gazetted in full before it can be incorporated in any municipal by-law by reference only and that the SABS has not been successful in getting an amendment to this effect through Parliament during the current session.

In view of the wide publicity given to these statements the AMEU Executive Council found it necessary once and for all to place all the relevant facts on record and has therefore submitted a comprehensive memorandum to the responsible Government Department concerned with these matters.

It is the intention that the Wiring Code be made a national wiring code for electrical installations and this will be achieved by incorporating it in an Act of Parliament viz. the Factories Act. This procedure has already been put in hand following the publication of the Government's views and decisions on the Wiehahn Commission's recommendations in respect of the Electrical Wiremen and Contractors Act.

This in turn will lead to the implementation of the authorisation procedure for new techniques and any innovative wiring systems by the relevant statutory authority in terms of the national wiring code.

## 3. Conclusion

Despite all the adverse criticism and publicity that municipal supply authorities are not co-operating fully with the adoption of the new Wiring Code and the implementation of new and innovative wiring systems, the ball appears to be squarely in the court of the South African Bureau of Standards, who have assumed responsibility for the revision of the SAIEE Standard Wiring Regulations and the administration and publication of the new Wiring Code which, together with the publication of any subsequent amendments, has become a cumbersome and lengthy procedure.

It can therefore be concluded that no useful purpose will be served at this point in time for this Subcommittee to pursue these matters any further or to carry on with its original objectives until new legislation in respect of the application of the Wiring Code and Wiring Work as such has been finalised.

J. K. VON AHLFTEN, Convenor

## MR. J. K. VON AHLFTEN: SPRINGS

Mr. President, you will note from the concluding remarks that I did say that this Committee seemed to have fulfilled its function, but I think we should review the position, especially in view of the fact that new regulations will be drawn up for electrical installation, and I suggest that we maintain this Committee and that the Executive reconstitute this Committee tomorrow. Maybe we should include a wider representation because I think this Committee will have fulfilled a very useful function when it comes to the implementation of the new regulations for the wiring of premises for electrical installations.

## MR. V. MacDONALD: ECA

Mr. President, the National Building Research Institute mentioned that there were some 17 000 houses per month that had to be completed between now and the year 2000. We have heard many people talking here about our labour problems.

If we are going to do this, Mr. President, and it is going to be necessary, I am pretty certain that we can get together and assist one another in the training aspect, perhaps with AMEU expertise and money, I am not sure. But perhaps we could look at something of that nature. But, on testing of installations, Mr. President, if you are going to do 2 000 or 17 000 houses a month, I do not know who is going to test them, but you know we have certain suggestions to make. We have made them to Mr. von Ahlften and they deserve consideration.

Mr. Weich, this morning, spoke about the National Inspection Council. I think this is something we are very keen on having implemented. I know there was a feeling that perhaps we should leave it until such time as the Electrical Wiremen's Contractors Act has finally been sorted out. If we are going to do that, Mr. President, it will be another 10 years before anything happens. I think the time is now that we have to get down to some positive steps and, at least, we can talk in the meantime.

Another point, Mr. President, I was accused of writing nasty things in the newspaper recently and some articles in various magazines but if it provokes thought, I am not repentant. We hear of such things as the Approvals Committee and discussion of whether it should be and whether it should not be. But we, as Electrical Contractors, are the people who have to carry out installations and quite honestly we have had a code of practice, which I know you people are feeling a little bitter and twisted about, because there have been a number of amendments made to it, but we, as Contractors, say why can we not use it?

Mr. President, a number of the Supply Authorities have agreed to use the Code of Practice. Here at the AMEU they have said, yes we will use it, but when we get outside, something else seems to creep in, namely by insert hyphen laws. Supply Authorities draft by-laws which nullify the whole use of the Code of Practice. If we are going to have Committees and a Bureau of Standards, but we are not going to accept their findings, where do we go? If cognisance is not going to be taken of what happens at those Committee meetings, then I would agree with those people who say that the Bureau of Standards is possibly one of the largest white elephants we have.

Mr. President, these particular meetings have cost a fortune. Please, if we agree to do something or if we have a particular problem and come up with a solution, let's not have to say, well the AMEU has approved it, the Bureau of Standards has approved it, but the local engineer has still got to poke it with his pen and have a good scratch to see whether it is acceptable or not. Thank you.

# REPORT ON THE WORK OF THE HIGH VOLTAGE CO-ORDINATING COMMITTEE 1979/1980

This Committee meets twice a year, normally during April and November, the latter being a formal meeting held at the CSIR headquarters in Pretoria, and the former an informal meeting held elsewhere. These meetings are well represented by a wide cross section of organisations involved directly (e.g. ESCOM and AMEU) or indirectly (e.g. SAR & H and GPO) in the power engineering industry or associated with it. The object of these meetings is to provide for co-ordination of research, particularly at high voltage, to focus attention on a national basis on problem areas and to discuss the most suitable approach for investigating these problems when necessary.

At the end of 1979, Dr. Hewitt, Vice President of the CSIR, who had been chairman of the committee since its inception, retired and his place as chairman for the 1980 meetings was taken by Dr. D. H. Jacobson, the new Vice-President of the CSIR.

A matter of particular interest discussed at the 1979 and 1980 meetings was the establishment of a national UHV (i.e. above 400 kV) testing facility jointly by ESCOM and the S.A. Bureau of Standards on a site near Pretoria. This facility will be managed and operated by the Bureau of Standards and will be available at an appropriate charge to any organisation requiring the use of these facilities. Similar facilities for research at voltages below 400 kV have already been installed by the Bureau and the CSIR and include the assistance of highly qualified specialists in various subjects.

The work of the Committee is mainly dealt with by a number of working groups, whose activities are co-ordinated and reported on by the various convenors, as follows:

## 1. EARTHING

- (a) Two "workshops" on power system earthing practices were held under the aegis of the SAIEE and a report on the conclusions, on which the proposed Code of Practice for Earthing will be based, is in course of preparation.
- (b) Investigation and testing of various types of earth electrodes is proceeding.
- (c) The AMEU's draft Code of Practice on the application of multiple earthing to low voltage distribution systems is to form the basis for a SABS Code of Practice on this subject.

## 2. SYSTEM DISTURBANCES

- (a) Municipalities with overhead transmission lines operating at 88 kV or higher voltages are asked to assist this working group by submitting data regarding the comparative annual frequencies of single phase, two phase and three phase faults per 100 circuit kilometres of line to the convenor, Mr. E. F. Raynham, Chief Engineer (Electrical) ESCOM, P.O. Box 1091, Johannesburg, 2090.
- (b) A special task force has been established under this working group to establish desirable limits of unbalanced voltage and harmonic content of high voltage supplies to consumers, and to lay down methods of determining these values in the field.

## 3. INSULATION

This group is involved inter alia in field testing of overhead line insulators of different types and designs to establish comparative performance under varying degrees of pollution. A special study was made of the high incidence of shattering of glass insulators on the Cabora Bassa line, the voltage gradient being different for DC from that for AC working conditions.

Investigations were also made into the cause of failure of an XLPE 132 kV cable installation and it was established that the jointing and terminating techniques required modification.

A small research facility into the behaviour of insulation in a compressed gas (e.g. SF6) environment has been established at the University of the Witwatersrand.

## 4. LIGHTNING

Work is still proceeding on standardised lightning flash counters which have now been installed for over 5 years at many sites in Southern Africa. A lightning flash intensity map of Southern Africa was published during the year. Investigations into lightning failure of 11 kV overhead distribution equipment were completed and the findings regarding arresters are being implemented by

ESCOM and SABS.

The activities of this group are directed by NEERI (The National Electrical Engineering Research Institute) and as a result of its work there is now a fairly clear understanding of the expected frequency mechanism and intensity of lightning strokes which is extremely valuable to the electricity supply industry.

## ELECTROMAGNETIC COMPATIBILITY

This group deals with the general problem of ensuring that electrical systems and equipment function as designed in their intended electromagnetic environment, without adversely affecting the operation of the other equipment.

## ROTATING MACHINES

Data on the failure in service of large rotating electrical machines is being collected, studied and recorded to try to determine whether these failures have a pattern and to suggest steps necessary to reduce the incidence of such failures and establish desirable manufacturing standards and test procedures.

W. BARNARD, Representative

# REPORT OF THE SOUTH AFRICAN NATIONAL COMMITTEE OF THE WORLD ENERGY CONFERENCE (SANCWEC) 1979/1980

In addition to the annual meetings, the South African National Committee had a special meeting in November 1979 to consider mainly the future role of SANCWEC. The committee also discussed correspondence with the Chairman of the State Energy Policy Committee in this regard.

The South African National Committee finally resolved:—

1. that SANCWEC should retain its membership of the WEC in order to monitor international developments in the energy field;
2. that SANCWEC should in return, supply co-ordinated information to WEC;
3. that SANCWEC should pass such information on international energy matters to the Energy Policy Committee to assist that body in the process of formulating energy policy;
4. that the Chairman, in consultation with persons he deems fit, prepare a list of possible new members of SANCWEC, with particular emphasis on the coal and oil industries;
5. that the general basis of the above discussion be conveyed to the Energy Policy Committee, including the proposed expansion of its representation to the coal and oil industries."

A delegation from South Africa, which included representatives from ESCOM, Atomic Energy Board, CSIR and the AMEU, attended the 11th World Energy Conference in

11th WORLD ENERGY CONFERENCE  
8-18 SEPTEMBER 1980  
MUNICH

The conference consisted of two parts, namely

1. Discussion of Conference Papers and meetings of Special Working and Study Groups.
2. Technical Visits.

The following is a schedule of the subjects dealt with in the Conference Papers:—

1. Energy Supply

- 1.1 Energy resources and their future availability
- 1.2 New systems of energy conversion, energy storage and energy transport
- 1.3 Rational use of energy and energy saving
- 1.4 Energy problems of the developing countries

2. Energy and Society

- 2.1 Energy demand in a developing society
- 2.2 International co-operation in the field of energy
- 2.3 Co-operation between developing countries and industrialized countries to meet energy demand

3. Energy and Environment

- 3.1 Energy requirements and energy technology for an improvement of the environment
- 3.2 Use of energy and its interference with the environment
- 3.3 International and interdisciplinary co-operation to safeguard the ecological system

4. Energy, Society and Environment

- 4.1 Interactions between energy consumption, economic growth, and society
- 4.2 Development and diffusion of knowledge as prerequisites for energy supply and protection of the environment
- 4.3 Impact of the general time factor and lead-times on society, energy supply, and the environment
- 4.4 Capital requirements for energy supply and protection of the environment.

1. Conference Sessions

Because of the wide scope of the Conference, it was impossible to attend more than a limited number of conference sessions, and I therefore concentrated on matters of greatest importance to the municipal electricity supply industry, which are mainly those dealt with under Division I — Energy Supply, Sections 1.1, 1.2 and 1.3. South Africa is no longer classified as a developing country and the subject matter dealt with in Section 1.4 was of limited interest.

The main conclusions reached at this Conference can be summarised as follows:—

(i) Energy Supply

The problem of energy supply for the world in the long term will only be solved by rapid development of nuclear energy. Solar energy (except for limited use for water heating by domestic users), wind power, wave energy etc., are considered to have limited potential in the foreseeable future for the needs of major users because these energy sources require abnormally heavy capital commitment. It was also considered that fossil fuels should be conserved as far as possible for the chemical industry for distillation and production of petro-chemical and synthetic-chemical products and not as a source of heat.

(ii) Energy Conservation

In the case of domestic consumers, conservation of electrical energy should be aimed at the often wasteful use of electricity for both space and water heating purposes. A tariff pricing policy to reduce consumption will invariably be counter productive, as consumers will change over to other less efficient and convenient forms of heating. The main field for conservation lies in commercial, industrial and transport applications, where considerable scope exists for energy conservation by the application of modern energy management techniques and the introduction of new technologies aimed at reducing overall consumption as well as peak demand.

(iii) Society and Environment

In recent years society has become more aware of its environment and has imposed increasing restrictions on the production and transmission of energy. The public should be well informed of the impact on the environment of energy production and transport facilities, more particularly fossil and uranium fuelled power stations, power transmission systems and other associated buildings and structures. Realistic criteria should be accepted by both parties if the problems of meeting energy needs are not to be compounded.

2. Technical Visits

The technical visit which was of the greatest interest to me personally was to the National Load Dispatch Centre at Munich. This control centre co-ordinates the power generated at all power stations in Germany to obtain optimum availability, and also arranges for interchange of power with virtually all countries in Europe on a commercial basis. In practice this means that if, at a particular time, increased demand in Germany requires running up a machine at a coal-fired power station when spare capacity is, for instance, available from a hydro-electric power station in Austria, this power could be purchased with a saving in cost and in consumption of fossil fuels.

It is generally felt that the greatest benefit derived from a conference of this nature, with delegates from every part of the world (attendance including delegates and accompanying persons numbered over 5000), is the contact and informal discussions that can be held. This conference was no different and I had many opportunities of discussing with engineers, projects of major significance and interest. One such project is the compressed air and gas pumped storage scheme at Hunterf in Germany. Here salt has been leached out of underground deposits and the resulting caverns used as large gas and air storage tanks.

This station, with a capacity of 180 MW (Orlando Power Station — 300 MW), has now operated satisfactorily for 18 months. This scheme is of particular interest to me, as in Johannesburg we have taken a preliminary look at the feasibility of using disused mine shafts in close proximity to the city, having suitable rock strata for excavation of caverns at a depth sufficient to give the required pressure for a similar scheme.

I also had informal discussions with engineers from many countries on electricity tariffs and load management, in particular in connection with the deferring of non-essential load and regarding pumped storage schemes. It should be appreciated that, being a coal exporting country, the Republic is not subject to the pressures now being put on many of the highly industrialized countries to reduce energy consumption per capita. Nevertheless the heavy drain increased electricity demand places on the capital, material and technical resources of any country requires that engineers and decision-makers in this country should be alert to the energy issues facing their overseas counterparts.

I would like to record my appreciation to the AMEU for sponsoring my attendance at this Conference and hope that my attendance will enable me to make a greater contribution to solving the vital energy problems facing the Republic. The next World Energy Conference will be held in Delhi, India in 1983.

W. BARNARD, Representative

## DISCUSSIONS BESPREKINGS

MR. W. BARNARD: JOHANNESBURG

Mr. President, I would just like to point out a few very brief matters. First of all, I refer, to the High Voltage Co-ordinating Committee report. You will note that reference is made to the workshop on power system earthing practices.

Under the second item, system disturbances, reference is made to the establishment of desirable limits of unbalanced voltage and we would ask for your support in analysing these factors because they are becoming more and more important, particularly with the proliferation of television.

Under 3, Insulation, will you please also note that certain research work is still being done on pollution of insulators on high voltage lines and here again we are seeking field results which will assist us in establishing the criteria to be taken into account in designing these systems.

Item 4, Lightning, is a very important aspect of the work being done by the committee. You will notice there that investigation is being made into the lightning failure of certain 11 kV equipment. This applies in particular to lightning arrestors, which have created a number of problems over many years for certain local authorities.

May I now come to the CSIR/NEERI report. I think that the most important thing I would like to point out here is the accelerated life assessment test on the 132kV cross linked polyethylene cables. It is hoped this might also give Mr. Botes some relief in taking a decision on the use of these cables in the future.

The report on the World Energy Conference is before you. I have nothing further to add, except to point out, as I mentioned before, that the next World Energy Conference, which is due to be held in 1983, will probably be in Delhi in India and the SA Delegation hopes it will be allowed to attend. Thank you.

DR. R. B. ANDERSON: CSIR

This committee was originally set up to investigate the acquisition of equipment and facilities for research and testing in the EHV and UHV field and this it has now accomplished by apportioning the responsibilities and the equipment to the three organisations concerned, namely ESCOM, the SABS and the CSIR.

The CSIR will be responsible for more basic research, for example on the breakdown mechanism in air and possibly SF<sub>6</sub> insulation and it will have facilities for measurement up to the nominal level of a 400 kV supply system — and, as indicated by Mr. J. D. N. van Wyk, the 3.3 MV impulse generator has been ordered and the 550 kV AC transformers are to follow shortly. Pro-rating of research to higher voltages as required would be done at the national EHV facility, which will serve the requirements of research and testing above 400 kV up to the nominal transmission voltage of 800 kV. ESCOM has also placed orders for an impulse generator which will initially be used for test on 800 kV designs, and the SABS presently has the establishment of the final national facility at Apollo (near Irene) under serious consideration.

However, as mentioned in your Representative's report, the committee is active in co-ordinating research on a voluntary basis in several other fields. These include that of Lightning, System Disturbances, Earthing, Insulation, Electro magnetic compatibility and Rotating Machines.

This Committee works through various Working Groups and Task Forces on which the AMEU is mostly represented, for instance, the Task Force for Lightning Protection of Distribution Lines and Substations, and that of the national survey of lightning flash density.

In the former, lightning problems affecting transmission and distribution of power and telecommunications are tackled and the results are thus immediately available to the AMEU. In the latter, as mentioned in the report, a five year map of the lightning flash density in the Republic has been produced and will be published for general use shortly. This will enable lightning protection to be rationalised and optimised according to the lightning flash density level, thus enabling cost savings to be achieved.

Your representative has very adequately covered details of the current work in each of these fields; in particular the inauguration of a code of practise for earthing should be mentioned, since the AMEU has taken the initiative in producing a draft which will be used as a basis for a national SABS Code.

In general, it can be said that the HVCC provides a means whereby the problems affecting any specific area in the Republic can be tackled on a national basis without duplication of effort or personnel, and the results made available to the respective authorities. Thank you.

MR. J. D. N. VAN WYK: CSIR

It has been the policy of NEERI to choose its research projects in fields which are of particular importance to the electrical engineering industry in South Africa. We also regularly collaborate with manufacturers and users in joint research ventures. Apart from our research, we have in addition spent a considerable proportion of our resources and time on assisting industry in solving problems where the required expertise or equipment fell outside existing facilities available from consultants or manufacturers.

### Lightning

Our work in the field of lightning research is a good example of choosing our research projects to be of direct benefit to local requirements. This work covers three main avenues namely:

1. A better understanding of the characteristics of lightning particularly concerning ground strokes;
2. A quantitative statistical determination of the lightning flash density and its geographical distribution; and
3. A study of the effect of lightning on structures, particularly power distribution systems.

Concerning the first aspect namely the characteristics of lightning you will recall that erected a sixty meter mast on the CSIR site, instrumented to record all the parameters of the lightning current and waveform of direct strikes of which we have had some 32 to date.

Secondly we developed and installed the RSA 10 lightning flash counter of which some 380 are presently installed over the whole of South Africa and the lightning density map representing the analysed data over the past five years is already available. This work will continue for at least another six years to cover a full eleven year solar cycle. Incidentally the RSA 10 flash counter has been adopted as the reference standard by CIGRE for all its programmes and we are actively assisting the USA, Mexico and several other countries in planning their measurement programmes.

In the third place, our work on the effect of lightning on transmission lines has covered in the past measurements on 400 kV lines, the Cabora Bassa HVDC line, 11 kV distribution lines as well as the three kilovolt traction lines of the SAR.

The most noteworthy at present is the collaborative project on an 11 kV test line together with ESCOM. This is unique in the world and has provoked considerable interest overseas, particularly amongst the USA utility companies.

It comprises a ten kilometer long woodpole construction and two automatic field stations which monitor disturbances caused by lightning upon the line, both direct and indirect, and locate the originating flashes. The programme is planned to cover at least five years and is now completing the third year. The first two years were concerned with fundamentals clarifying range of disturbances, etcetera. The third year was concerned with performance of surge-arrestors and during the fourth year, now beginning, the line will be energised.

Apart from considerable clarification of disturbance mechanisms, preliminary recommendation for design of future rural distribution lines in severe lightning environments is that the objective should be a co-ordinated insulation impulse withstand level around 300 to 400 kV, in contrast to present day practise.

Our work on striking distance determination, primarily based on measurements carried out at the lightning tower, is also changing thinking in this area and again provoking considerable interest overseas.



## High Voltage Facilities

Whereas, in the past, most of our work has been based on observing the natural phenomenon, we plan within the near future to acquire a suitable HV test equipment to enable us to extend this work into the controlled laboratory environment.

More will be said about this under the discussion of the HV Co-ordinating Committee report by Dr. R. B. Anderson. It is sufficient to mention here that by co-ordination between the CSIR, ESCOM and the SABS we will soon have extensive and very modern HV facilities for research and testing in the country to cover every voltage up to EHV levels.

The CSIR undertook to provide research facilities to cover system voltages up to 400 kV and our impulse generator of 3.3 megavolts and 380 kilojoules capacity will be delivered at the beginning of June this year. Two 550 kV transformers capable of two amperes continuous rating are also on order.

## Assistance to Industry

In the field of direct assistance to industry, I wish to mention three projects briefly:

A large industrial concern using 132 kV cross-linked polyethylene cables experienced some problems due to unexpected failures. In collaboration with the SABS we erected a research facility in eight weeks in which accelerated life studies on cables could be carried out. The problems were soon tracked down to incorrect methods of jointing and termination and remedies could be suggested and tried out in the laboratory. These are now being introduced in the field and our work will be rounded off by assessing the life of the modified systems to prove the long-term stability of the changes.

In the field of industrial system disturbances we have developed measuring techniques and equipment housed in a mobile laboratory to enable measurements to be made in hostile industrial areas such as arc furnace plants, etcetera and to suggest remedies to correct the problems.

Thirdly, our programme of measurement and monitoring of insulation quality of high voltage motors is progressing well. More than 250 motors are measured annually by our mobile laboratory in a collaboration programme which includes the Rand Water Board, ESCOM, Chamber of Mines and ISCOR. Several instances have occurred where machines having indication of poor insulation have failed shortly thereafter. In other cases, the machines have been rewound before such an event could take place.

## Symposia

Your representative, Mr. Barnard, referred to the international symposium on Automation in Power Generation, Distribution and Protection held under the auspices of the International Federation of Automatic Control (IFAC). This was a very successful symposium which attracted a very high quality of papers. As a result of this IFAC decided to make this a regular series at intervals of three years. The next is likely to take place in Brazil in 1982. Our Institute was also closely involved in symposia and workshops organised by the SAIEE, for example the Workshop on "Neutral Earthing" was judged to be one of the most successful during this year.

## Battery Vehicles

Many of you who agree to co-operate in the pilot study on the use of battery powered road vehicles must have been disappointed when this did not materialize. The authorities decided that they would prefer to consider supplementing individual proposals originating from industry rather than supporting a pilot scheme as was originally visualised. We still hope that this will not stagnate and we will keep you informed. Our Institute together with several universities is continuing research work and we are also participating in the measurement aspects involved in the Johannesburg Municipality and the Department of Transport's scheme to evaluate trolley buses for use in city transport. Thank you.

# REPORT OF THE CSIR NEERI ADVISORY COMMITTEE 1979/1980

1. Following a reorganisation of the Institute, Dr. Anderson has been appointed Assistant Director, Research, Mr. J. H. J. Filter Assistant Director, Development and Dr. A. J. Eriksson, Head Electric Power Department. The Institute took occupation of its new building on the CSIR campus during 1980 and the formal opening took place on 28 November 1980.
2. The Advisory Committee is now assisted by subcommittees for Power Electrical Engineering, Cybernetics and Semiconductor Technology, which met during October 1980. The new chairman of the committee is Dr. J. H. Jacqson, who is also a Vice-President of the CSIR.
3. The Institute was involved in organising an IFAC symposium on Automatic Control in Power Generation Distribution and Protection, which was held during September 1980. The symposium, for which the AMEU was also a co-sponsor, was attended by about 320 delegates and drew very favourable comment from the large number of overseas delegates.
4. Many of the activities of the Electric Power Department are closely linked to the work of the High Voltage Co-ordinating Committee and have been reported on under that heading. Of particular interest, however, is the service provided to industry by the Power System Disturbances Division, which undertakes the analysis of switching surges and harmonic distortion. The Power Subcommittee agreed that the Institute could be called upon to advice on this subject since it had already collected a considerable amount of data which displayed a recognisable pattern. Another project of interest to power distribution engineers is an accelerated life assessment test of 132 kV XLPE cables for SASOL.
5. The Advisory Committee considered that, in addition to investigations on trouble-shooting aspects and pure fundamental research work, more attention should be given to long-term development projects in collaboration with industry as is done, for example, in the case of the motor insulation evaluation project.

W. BARNARD, Representative



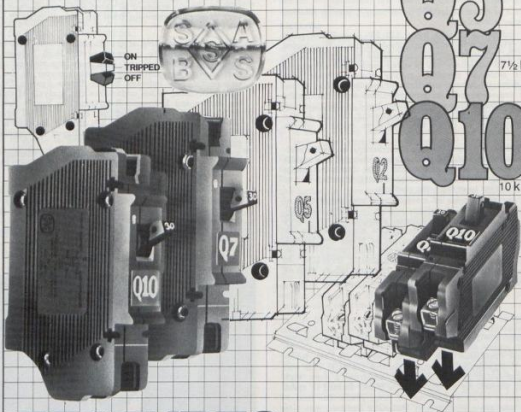
Mr. Wessel Barnard

# FUCHS

FUCHS introduced the clip-in moulded case circuit breakers nearly three decades ago. Anticipating today's demand, they developed the extended Quicklag range.

## A new generation in clip-in circuit breakers

Q2 2½ k A.  
Q5 5 k A.  
Q7 7½ k A.  
Q10 10 k A.



## FEATURES

- Already in production. • All units carry the SAB S mark. • Fits existing clip tray.
- Completely interchangeable and extremely versatile. Matching existing module sizes. • Replaceable by any international breaker (American standard = 25,4 mm width).
- Instantaneous trip. • Manually independent) i. e. overcentre spring loaded opening and closing

- operations providing three positions "On", "Off" and "Trip".
- Designed to your specifications.
- Ambient compensation. • Standard curve. • Discriminating curve. • Load limiting curve. • Surge arresters.
- Load control relays. • A locally manufactured product by a 100% South African owned company.

- For further technical or application advice refer to:  
FUCHS ELECTRICAL BRANCHES AT:  
TVL/OPS (011) 864-1800. WEST CAPE  
(021) 93-3125. NATAL (031) 37-3665.  
EAST CAPE (041) 41-2931.



## CSIR/NBRI SOLAR ENERGY AND ENERGY CONSERVATION (SEC) STEERING COMMITTEE

Because of the increasing general interest and concern currently being shown in the utilization of solar energy your Executive Council resolved after the 46th Convention held in Johannesburg in 1979, that it was desirable that the AMEU should be represented on the Steering Committee established recently by the National Building Research Institute (NBRI) of the Council for Scientific and Industrial Research (CSIR) to investigate Solar Energy and Energy Conservation in Buildings and the Built Environment.

Upon request the NBRI agreed to such representation and your Executive Council nominated myself as its representative on this Steering Committee, with Mr. W. Barnard as alternate.

Close on thirty national bodies serve on this Steering Committee, including organisations representative of the public sector, commerce and industry. Since the last Convention there have been two meetings of the Steering Committee at which a wide range of topics was discussed. A considerable amount of useful work has been undertaken in a number of solar water heating, solar air-conditioning and lighting. The diverse fields, including energy conservation in buildings, NBRI is engaged on a number of research projects, including solar water heating for the lower income groups, energy consumption patterns in buildings, the insulation of domestic water heaters and the economics of solar water heating. Other bodies, such as the Department of Environmental Planning and Energy, the National Mechanical Engineering Research Institute, the Energy Research Institute of the University of Cape Town, to mention but a few, are also actively engaged in a number of research projects.

One of the topics discussed that is of particular interest to municipal electricity undertakings, is that of solar water heaters and peak load control. Since the use of solar energy for water heating, and to a lesser extent for space heating and air-conditioning, will clearly reduce the demand for and hence the consumption of electricity, there will obviously be some impact on sales and hence the cost of electricity. Generally speaking the reduction in demand will be greater in the summer, when the load is already relatively low, than in the winter. The reduction in energy sold will accordingly be greater than the associated reduction in annual maximum demand. In other words there will be a reduction in load factor with an attendant increase in the average cost of electricity. Solar energy has so far made little impact on sales of electricity and it is likely to be many years before serious consideration need be given to this problem by electricity undertakings.

It is important to note, however, that although the large scale employment of solar energy in the future could adversely affect the cost of electricity this does not necessarily imply that the price of electricity will be similarly adversely affected. Although tariff rates are generally based on the cost of supply they can be influenced by political decisions and prices adjusted relatively through a cross-subsidisation of rates. For instance, there could be a special rate for solar consumers, with the rate being either higher than normal to reflect the higher cost of supplying this group, or lower than normal to encourage the installation of solar systems.

Several members of the Steering Committee were of the opinion that some form of peak load control, such as ripple control or load control relays, should be employed by electricity undertakings to reduce peak loads. But such load reduction systems are already being employed by a large number of electricity undertakings, particularly to switch out water heaters at times of system peak. In any case, such systems can be, and are, employed independently of whether water heaters are solar assisted or not. Solar systems, therefore, cannot rightly be credited with any reduction in demand stemming from the use of load control systems. The fact remains, though, that either with or without some form of

## WNNR/NBNI LOODSKOMITEE INSAKE NAVORSING OOR SONENERGIE EN ENERGIEBESPARING (SEEB)

Omrede die toenemende algemene belangstelling en besorgdheid wat tans getoon word in die aanwending van sonenergie het u Uitvoerende Raad sedert die 46ste Konvensie wat te Johannesburg in 1979 gehou is, beslis dat dit wenslik is dat die VMEO verteenwoordig word op die Loodskomitee wat onlangs deur die Nasionale Bounavorsingsinstituut (NBNI) van die Wetenskaplike- en Nywerheidsnavorsingsraad (WNNR) tot stand gebring is om Sonenergie en Energiebesparing in Geboue in die Beboude Omgewing te ondersoek.

Op versoek het die NBNI ingestem tot so 'n verteenwoordiging en u Uitvoerende Raad het my genomeer as sy verteenwoordiger op die Loodskomitee met Mnr. W. Barnard as alternatiewe lid.

Ongeveer dertig nasionale instansies dien op hierdie Loodskomitee wat organisasies insluit wat die publieke sektor, die handel en nywerheid verteenwoordig. Sedert die laaste Konvensie is twee vergaderings van die Loodskomitee gehou waar 'n groot verskeidenheid onderwerpe bespreek is. 'n Aansienlike hoeveelheid nuttige werk is gedoen in uiteenlopende velde, insluitende energiebesparing in geboue, sonwaterverhitting, sonlugsorging en verligting. Die NBNI is besig met 'n aantal navorsingsprojekte, insluitende sonwaterverhitting vir die laer inkomste groepe, energieverbruikerspatrone in geboue, die isolering van huishoudelike waterverwarmers en die ekonomie van sonwaterverhitting. Ander liggame soos die Departement van Omgewingsbeplanning en Energie, die Nasionale Navorsingsinstituut vir Meganiese Ingenieurswese, die Energie navorsingsinstituut van Universiteit Kaapstad, om maar 'n paar te noem, is ook daadwerklik bedrywig met 'n aantal navorsingsprojekte.

Een van die onderwerpe wat bespreek en van besondere belangstelling vir munisipale elektrisiteitsondernemings is, is dié van sonwaterverwarmers en spitsvragbeheer. Aangesien die gebruik van sonenergie vir waterverwarming en tot 'n mindere mate vir ruimteverwarming en lugversorging duidelik die aanvraag vir en gevolglik die verbruik van elektrisiteit, sal verminder, sal daar vanselfsprekend 'n sekere mate van aanslag op verkope en gevolglik op die koste van elektrisiteit wees. Algemeen gesproke sal die vermindering in aanvraag groter wees in die somer wanneer die las reeds relatief laag is, as in die winter. Die afname in energie verkoop sal gevolglik groter wees as die verwante afname in die jaarlikse maksimum aanvraag. Met ander woorde, daar sal 'n afname in die laastfaktor wees met 'n saamgaande vermeerdering in die gemiddelde koste van elektrisiteit. Sonenergie het tot dusver weinig aanslag gemaak op die verkope van elektrisiteit en dit sal waarskynlik baie jare duur voordat ernstige aandag gegee moet word aan hierdie probleem deur elektrisiteitsondernemings.

Dit is belangrik om daarop te let, egter, dat alhoewel die grootskaalse aanwending van sonenergie in die toekoms nadelige gevolge op die koste van elektrisiteit kan hê, dit nie noodwendig te kenne gee dat die prys daarvan ooreenkomstig nadelig geraak sal word nie. Alhoewel tariewe in die algemeen gebaseer word op die koste van voorsiening, kan hulle beïnvloed word deur politieke besluite en pryse relatief aangepas deur kruissubsidisering van tariewe. Daar kan byvoorbeeld 'n spesiale tarief vir sonenergieverbruikers weeg wat óf hoër as gewoonweg is om die hoër koste van voorsiening aan dié groep te reflekteer, óf laer as gewoonweg om die aanbring van sonstelsels aan te moedig.

Verskeie lede van die Loodskomitee was van mening dat een of ander vorm van spitsbeheer soos byvoorbeeld rimpelbeheer, of lasbeheerrelê gebruik behoort te word deur elektrisiteitsondernemings om die spitslaaste te verminder. Maar sulke lasverminderingstelsels word reeds gebruik deur 'n groot aantal elektrisiteitsondernemings, in besonder om waterverwarmers gedurende spitslaaste uit te skakel. In iedere geval, sulke stelsels kan en word afsonderlik gebruik óf waterverwarmers deur die son bygestaan word, óf te nie. Sonstelsels kan dus nie na regte gekrediteer word met enige afname in die aanvraag komende van die gebruik van beheerstelsels nie. Dis 'n voldonge feit egter, dat met of sonder een

load control, less energy will be sold by electricity undertakings when supplementary solar systems are employed. Consequently, any overhead costs, including any residual demand costs not directly recoverable, must be recovered indirectly through the sale of fewer units. The end result is that either way it must cost more to supply solar energy consumers; how much is merely a question of degree.

Concern was also expressed by these same members of the Steering Committee that electricity undertakings were not enthusiastic about the large scale employment of solar installations since income will inevitably decrease and as most undertakings budgeted for a surplus on their trading accounts, any such surplus would accordingly be decreased. The point that is overlooked here is that any surplus on electricity trading effectively belongs to the consumers and is returned to these same consumers, as ratepayers, through the financing of other community projects. Clearly, as the money is retained in the community the community as a whole does not suffer on this account.

It has also been said by these same authorities that electricity suppliers see their business as suppliers of electricity and that any reduction in consumption or the employment of alternative energy sources runs counter to their interest and should accordingly be vigorously resisted. The point is made that as the electricity supply undertaking is acting in the interests of the community it should act in the communities' overall best interest and should not see solar energy, for instance, as a competitor. It is furthermore contended that the electricity suppliers should rather see themselves in the role of "energy" suppliers, embracing not only the more effective utilization of national energy resources but also the conservation of energy generally.

Strong views along the above lines have been expressed at different times by several members of the Steering Committee, apparently without ever having solicited the views of the electricity supply industry. In other words, it has merely been assumed that the electricity supply industry, and this includes ESCOM as well as the municipal electricity undertakings, are strongly opposed to the widespread use of solar energy, viewing solar energy as a competitor and one that will reduce their profits. But as far as I am aware this has never been the case, the electricity supply industry being quite neutral in the matter, particularly as solar energy is neither, nor ever likely to be, a serious competitor or any threat to the industry's existence. I would submit that if this is in fact the case, then the AMEU, at least, through this Convention, should make its views publicly known. Surely councillors and senior municipal officials are sufficiently mature in outlook not to adopt such a negative attitude and to oppose the use of solar energy if it happens to be in their communities' interest as well as in the overall national interest? In fact, the United Municipal Executive (UME) has officially advised the NBRI that it is fully aware of the necessity for energy conservation.

But is the encouragement of the widespread utilization of solar energy really a top national priority? Possibly not. It has repeatedly been stated by several members of the Steering Committee that the country's problem is not one of energy shortage but rather of capital scarcity, particularly foreign exchange. In other Western countries energy conservation is a top priority because of these countries' heavy dependence on imported oil. But this is not the case in South Africa with our abundance of coal. Experts in this field have frequently stated that with more effective utilization of our coal resources, there is no immediate necessity to conserve energy for this reason.

Conservation of capital, however, is another matter altogether. There is no doubt that the burden on scarce capital resources faced by the electricity supply industry can be eased through the widespread use of solar energy. For instance, one member of the Steering Committee has rightly expressed the view that increasing growth in the electricity supply industry will require increasing investment in costly capital plant and that the position will be further aggravated by lack of foreign exchange and skilled manpower and the need to minimise pollution and to make maximum use of

of ander vorm van lasbeheer, minder energie verkoop sal word deur elektrisiteitsondernemings indien bykomende sonstelsels aangewend word. Gevolglik moet enige oorhoofse koste, insluitend enige oorblywende aanvraagkoste wat nie direk verhaalbaar is nie, indirek verhaal word deur die verkoop van minder eenhede. Die slotsom is dat in iedere geval dit meer moet kos om sonenergieverbruikers te voorsien; hoeveel is eintlik net 'n saak van tot watter mate.

Sorg is ook uitgespreek deur hierdieselfde lede van die Loodskomitee dat elektrisiteitsondernemings nie geesdrifdig is omtrent die grootekalase aanwending van son-installasies nie aangesien inkomste onvermydelik sal verminder en aangesien die meeste ondernemings begroot vir 'n surplus in hulle handelrekeninge, enige sodanige surplus gevolglik kleiner sal wees. Die punt wat hier oor die hoof gesien word is dat enige surplus in elektrisiteitsverkope in verband met die verbruikers behoort en aan dieselfde verbruikers as belastingbetalers terugbesorg word deur middel van die finansiering van ander gemeenskapsprojekte. Aangesien die geld klaarlik in die gemeenskap gehou word, is die gemeenskap as 'n geheel nie 'n verlies om hierdie rede nie.

Dit is ook gesê deur hierdieselfde gesagte dat elektrisiteitsvoorsieners sien hulle besigheid as voorsieners van elektrisiteit te wees en dat enige afname in die verbruik of die aanwending van alternatiewe energiebronne, teenstrydig is met hulle belange en behoort gevolglik sterk weerstaan te word. Dit word beweer dat aangesien die elektrisiteitsvoorsieningsonderneming in die belange van die gemeenskap optree, hy in die gemeenskap se algehele beste belange behoort op te tree en sonenergie nie byvoorbeeld as mededinger te beskou nie. Verder word dit beweer dat elektrisiteitsvoorsieners hulle eerder in die rol van "energievoorsieners" behoort te sien wat nie alleen die meer effektiewe aanwending van nasionale energiebronne omvat nie maar ook die besparing van energie in die algemeen.

Sterk sienenswaardig volgens die begemelde opsigte is uitgespreek by verskillende tye deur verskeie lede van die Loodskomitee, vermoedelik sonder om ooit eers die sienenswaardig van die elektrisiteitsindustrie in te win nie. Met ander woorde, dit is slegs aanvaar dat die elektrisiteitsindustrie, en dit sluit EVKOM sowel as die munisipale elektrisiteitsondernemings in, sterk gekant is teen die uitgebreide gebruik van sonenergie, beskouende sonenergie as 'n mededinger en een wat hulle profyte sal verminder. Maar vir sover ek weet was dit nog nooit die geval nie. Die elektrisiteitsvoorsieningsindustrie is in die geheel neutral in die saak veral aangesien sonenergie nie in nooit ooit 'n ernstige mededinger of dreigement vir die industrie se bestaan sal wees nie. Indien dit wel die geval sou wees, behoort die VMEGO dan ten minste deur middel van die Konvensie sy sienenswaardig publiek te maak. Raadslede en senior munisipale amptenare is seer sekerlik volwasse genoeg in hulle uitkyk om nie so 'n negatiewe houding in te neem en die gebruik van sonenergie teen te staan indien dit in hulle gemeenskap se belange sowel as die algehele nasionale belange, sou wees nie. Inderdaad die Verenigde Nasionale Bestuur (VNB) het die NBNI officieel verwittig van sy bewustheid van die noodigheid om energie te bespaar.

Maar is die aanmoediging tot 'n uitgebreide aanwending van sonenergie werklik van die hoogste voorrang? Heel moontlik nie. Dit is herhaalbaar deur verskeie lede van die Loodskomitee verklaar dat die land se probleem nie een van energietekort is nie maar wel van kapitaaltekort, veral buitelandse valuta. In ander Westerse lande geniet energiebesparing die hoogste prioriteit weens dié lande se groot afhanklikheid van ingevoerde olie. Dit is egter nie die geval in Suid-Afrika nie met ons oorvloed van steenkool. Deskundiges op hierdie gebied het dikwels beweer dat met meer effektiewe aanwending van ons steenkoolbronne, daar nie om hierdie rede 'n onmiddellike nood bestaan om energie te bespaar nie.

Besparing van kapitaal is egter heeltemal 'n ander saak. Daar bestaan geen twyfel dat die las op skaars kapitaalbronne ondervind deur die elektrisiteitsvoorsieningsindustrie verlig kan word deur die uitgebreide aanwending van sonenergie nie. Een lid van die Loodskomitee het byvoorbeeld heeltemal reg die mening uitgespreek dat toenemende groei in die elektrisiteitsvoorsieningsindustrie 'n toenemende belegging in duur kapitaal-bedryfsuitrusting sal benodig en dat die posisie verder sal vererger deur die tekort van buitelandse valuta en geskoolde mannekrag, die behoefte om besoedeling

scarce water resources. Since the widespread use of solar energy can possibly assist in the more effective utilization of capital plant it is argued that the employment of solar energy should be encouraged.

It is of interest to note, however, that the Department of Environmental Planning and Energy has advised the NBRI that the Government is giving continuous attention to all aspects of the formulation and implementation of a national energy policy. The Government has also advised, however, that it does not see any conflict between the use of electricity sales as a source of income and the promotion of energy conservation and accordingly does not consider that the present electricity tariff structure in the country is wholly incompatible with the principle of electricity conservation.

The Department of Environmental Planning and Energy has also advised the NBRI in response to a request for substantial incentives by way of modified fee structures and tax reductions that the Government cannot recommend any tax or other financial measures as incentives to conserve energy.

It would appear, therefore, that the official Government view is that there is, at least at this stage, no measure of urgency to embark upon any extensive solar energy programme.

As mentioned earlier the NBRI is engaged in a number of projects and studies. It is also planned to undertake a number of surveys to determine the degree to which electricity peak demand can be reduced through the use of solar installations. A further countrywide survey is also planned to determine the utilization of electrical energy in domestic premises. Questionnaires are to be distributed to about twenty local authorities with the request that they record data on electricity consumption over a one year period in five different economic classes of home. The purpose of this latter survey is as follows:

- (i) to obtain more representative statistics on electricity usage;
- (ii) to determine the relationship between electricity usage and the financial means of the household;
- (iii) to determine to what extent climate influences electricity consumption;
- (iv) to determine to what extent winter conditions influence the peak demand for electricity;
- (v) to obtain information in respect of the supply and cost of electricity.

The NBRI also plans a survey of a limited number of homes having solar installations to assess their performance, reliability and the before and after consumption of electricity.

The SABS is continuing its work of preparing specifications covering various components of solar energy systems. A code of practice is also being developed to cover the performance of the whole system.

As an interim measure pending the preparation of standard specifications and a code of practice by the SABS, the Agrément Board of South Africa has agreed to grant certificates to approved solar water heating systems. In granting such certificates the Board considers that it can play an active role in encouraging a greater use of solar energy for the heating of water while at the same time reducing the risk of expensive failures which would inevitably reflect poorly on the industry as a whole.

Agrément certificates, the first of which was recently granted to a solar system, are issued for building innovations not covered by existing building legislation, standard specifications or codes of practice. The certificates are intended to provide the manufacturers with a document, recognised by building authorities and public and client bodies, which contains sufficiently detailed, objective and authoritative technical information to permit an informed decision to be taken on the suitability of the innovation for a particular purpose.

In the interests of energy conservation the NBRI has published widely distributed and publicised an open letter to householders on how to save money by reducing standing losses on electric water heaters. Two measures are proposed, firstly a reduction of the thermostat setting to 55° C and secondly, improving the insulation of the water heater. Aris-

te verminder en om maksimum gebruik te maak van skaars waterbronne. Aangesien die uitgebreide gebruik van sonenergie heel moontlik kan help met die meer effektiewe benutting van kapitaal-bedyfstruiking is dit die mening dat die aanwending van sonenergie aangemoedig behoort te word.

Dit is van belang om daarop te let egter dat die Departement van Omgewingsbeplanning en Energie die NBRI verwittig het dat die Regering ongebroke aandag skenk aan alle aspekte van die formulering en uitvoering van 'n nasionale energiebeleid. Die Regering het egter ook bekend gemaak dat hy nie bewus is van 'n geskik tussen die gebruik van elektrisiteitsverkepe as 'n bron van inkomste, en die bevordering van energiebesparing nie en gevolglik nie dink dat die huidige elektrisiteitstariefstruktuur in die geheel onverenigbaar met die prinsiep van energiebesparing is nie. Die Departement van Omgewingsbeplanning en Energie het ook die NBRI verwittig op aandrang van 'n versoek om aansienlike aansporings deur middel van gewysigde fooistrukture en belastingvermindings, dat die Regering nie enige belasting- of ander finansiële stappe as aansporing kan aanbeveel nie.

Dit blyk dus dat die amptelike siening van die Regering is dat daar ten minste tans geen mate van dringendheid bestaan om 'n uitgebreide sonenergieprogram te aanvaar nie.

Soos vroeër gemeld is die NBRI besig met 'n aantal projekte en studies. Dit word ook bepaal om 'n aantal opnames te onderneem om vas te stel tot watter mate die elektrisiteitspitsaanvraag verminder kan word deur die gebruik van soninstallasies. 'n Verdere landswye opname is ook beplan om die benutting van elektriese energie in huishoudelike persele vas te stel. Vraelyste gaan versprei word onder ongeveer twintig plaaslike owerhede met die versoek dat hulle gegewe inlym, die verbruik van elektrisiteit oor 'n tydperk van een jaar in vyf verskillende ekonomiese stande van woonhuise aanteken. Die doel van laasgenoemde opname is soos volg:—

- (i) om meer verteenwoordigende statistieke i.v.m. die gebruik van elektrisiteit te verkry;
- (ii) om die verhouding tussen die elektrisiteitsverbruik en die finansiële middele van die huiseienaar te bepaal;
- (iii) om te bepaal tot watter mate klimaat die verbruik van elektrisiteit beïnvloed;
- (iv) om te bepaal tot watter mate wintertoestande die spitsaanvraag van elektrisiteit beïnvloed;
- (v) om gegewe inlym, die voorsiening en koste van elektrisiteit te bekom.

Die NBRI beplan ook 'n opname van 'n beperkte aantal woonhuise wat soninstallasies het om hulle werkverrigting en betroubaarheid en die voor- en naverbruik van elektrisiteit te bepaal.

Die SABS gaan voort met sy werk om spesifikasies wat die verskeie onderdele van sonenergiesistels dek, voor te berei. 'n Gebruikskode om die werkverrigting van die stelsel te dek is ook onder ontwikkeling.

As 'n tussentydse maatregel in afwagting op die bereiding van standaardspesifikasies en 'n gebruikskode deur die SABS, het die Agrément-raad van Suid-Afrika ingestem om sertifikate uit te reik vir goedgekeurde sonverwarmingstelsels. Met die uitreiking van sulke sertifikate beskou die Raad dat dit 'n aktiewe rol kan speel om die groter gebruik van sonenergie vir die verwarming van water aan te moedig en dieselfde tyd die risiko van duur onderbrekings wat die industrie as 'n geheel onvermydelik in 'n swak lig sal stel, te verminder.

Agrément-sertifikate waarvan die eerste onlangs vir 'n sonstelsel uitgereik is, word uitgereik vir bouunwagheid wat nie deur bestaande bouwetgewing, standaardspesifikasies of gebruikskodes gedek word nie. Die sertifikate is bedoel om vervaardigers met 'n dokument, erken deur bou-owerhede 'n publieke en klientinstansies, te versorg wat genoegsame gedetailleerde, objektiewe en gesaghebbende tegniese informasie bevat om 'n ingeligte besluit aangaande die geskiktheid van die nuwigheid vir 'n besondere doel te maak.

In belang van energiebesparing het die NBRI 'n ope brief gepubliseer en wyd versprei aan huiseienaars hoe om geld te bespaar deur warmteverliese in waterverwarmers te verminder. Twee metodes word voorgestel, eerstens 'n verlaging van die termostaatstelling tot 55° C en tweedens deur die isolasie van die waterverwarmer te verbeter.

ing out of representations made by the Good Hope Branch to the Executive Council, the AMEU advised the NBRI that in its opinion certain phraseology in the letter ran counter to safe practice by condoning tampering with electrical equipment by laymen. It accordingly considered it prudent to dissociate itself from any active participation in the distribution of this letter. The Steering Committee, however, did not support this view and requested that the AMEU be advised that this was an independent NBRI publication and that local authorities were only being requested to assist in its distribution. It was subsequently pointed out to the Steering Committee that the AMEU was not opposed in principle to the recommendations, merely that as a body concerned with electrical safety it considered that it should not be directly involved.

The Steering Committee has commented on the apparent lack of enthusiasm shown by the public generally in solar energy installations. The main reason for this apathy is probably because solar heating systems are still only marginally economically attractive, and then only in those areas where the cost of electricity is relatively high. A further reason could be the lack of acceptable national standards.

Despite this lack of enthusiasm by the public and support from the Government for the more active exploitation of solar energy, it is nevertheless considered that the AMEU should still closely monitor the situation and keep in touch with developments and progress in this field, particularly the influence on load patterns and hence future cost structures.

It is considered that solar appliances can be looked upon as negative loads. In other words, they do not add to but rather reduce the overall load of a consumer. What different types of appliance a consumer connects to his installation is surely his concern, be they for argument's sake lights, heaters, motors or solar installations. The load mix, however, will naturally affect the load factor and accordingly the cost of supply. Other than monitoring the influence on load patterns it is considered that there is really no necessity for electricity undertakings to become deeply involved in the installation of solar energy systems. Apart from the connection of any electrical components, as in conventional electrical water heaters, the work is largely a plumbing job and as such should be left to the Town or City Engineer.

A number of differing opinions have been put forward in this report. In order to assist in putting the AMEU's official viewpoint to the Steering Committee the comments of members would be welcomed.

**D. C. PALSER**  
**REPRESENTATIVE/VERTEENWOORDIGER**

As gevolg van aandrag deur die Goede Hoop-tak tot die Uitvoerende Raad het die VME0 die NBRI verwittig dat syns insiens sekere woordkeuse in die brief afbreuk doen aan die veilige gebruik deur die peuter met elektriese apparaat deur leke goed te keur. Die Tak het dit gevolglik verstandig geag om hom te distansieer van enige aktiewe deelname in die verspreiding van die brief. Die Loodskomitee het egter nie die mening gesteun nie en versoek dat die VME0 verwittig word dat dit 'n onafhanklike NBRI-publikasie is en dat plaaslike owerhede alleenlik versoek is om met die verspreiding te help. Dit is sedertdien aan die Loodskomitee uitgewys dat die VME0 nie teen die beginsel van die aanbevelings gekant is nie maar net as 'n liggaam wat te doen het met die veiligheid van elektrisiteit, van mening is dat hy nie direk betrokke behoort te wees nie.

Die Loodskomitee het melding gemaak van die blykbare gebrek aan entoesiasme getoon deur die publiek oor die algemeen in sonenergie-installasies. Die hoofrede vir dié onverskilligheid is waarskynlik omdat sonverwarmerstelsels steeds ekonomies skaars aantreklik is en dan alleenlik in daardie gebiede waar die koste van elektrisiteit relatief hoog is. 'n Verdere rede kan dalk die gebrek aan aanneembare nasionale standarde wees.

Nieteenstaande hierdie gebrek aan entoesiasme deur die publiek en steun deur die Regering vir die meer aktiewe eksplorasie van sonenergie, is dit nogtans die mening dat die VME0 die situasie goed moet dophou en in voeling bly met ontwikkeling en vooruitgang in hierdie veld, in besonder die invloed op laspatrone en gevolglik toekomstige koste-strukture.

Dit is die mening dat sontoestelle beskou kan word as negatiewe laste. In ander woorde hulle dra nie tot die algehele las van die verbruiker by nie maar verlaag dit eerder. Watter verskillende tipe toestelle 'n verbruiker aan sy installasie verbind, is tog seker sy saak, óf hulle argumentshalwe ligte, verwarmers, motors of son-installasies insluit al dan nie. Die lasmengsel sal egter natuurlik die lasfaktor beïnvloed en gevolglik die koste van voorsiening. Anders dan om die invloed op laspatrone dop te hou, is dit die mening dat dit eintlik nie nodig is vir elektrisiteitsondernemings om diep betrokke te raak met die aanbring van sonenergiestelsels nie. Afgesien van die aanbring van enige elektriese onderdele, soos in konvensionele waterverwarmers is die werk grootliks 'n loodgieterstaak en as sulks behoort dit aan die Stadsingenieur oorgelê te word.

'n Aantal uiteenlopende menings is uiteengesit in hierdie verslag. Om te help om die VME0 se offisiële standpunt aan die Loodskomitee voor te lê sal kommentaar van lede verwelkom word.

Mnr. die President, die versoeking was groot om met hierdie inleiding tot die bespreking vir u allerhande statistieke te gee, wat miskien uitgesoek soos wees, om my eie siening te ondersteun. Soos u weet die siniese gesegdes oor statistiek en statistici is legio. U ken hulle so goed soos ek, daar word gepraat van "Lies, damn lies and statistics" of soos 'n ander een dit gestel het "If all the Statisticians in the world were put head-to-foot, it would be a good thing".

Ek persoonlik is nie so sinies oor korrek toegepaste statistiek nie. Ek het die versoeking egter weerstaan omdat ek voel dat ons met ons gestry oor die korrektheid van die eerste of tweede desimale dikwels die kernaak miskyk.

As voorbeeld mnr. die President, daar is etlike beramings deur verskeie deskundige groepe gemaak van ons steenkool-reserwes. Daar is net soveel persone en organisasies wat weer hierdie beramings bevestigende of verkeerd probeer bewys. Die kernaak waaroor dit gaan is egter dat almal weet die hoeveelheid is eindig en tweedens stem almal blykbaar saam dat om en by die jaar 2 000 ons 'n ernstige energiekrisis, sover dit bronne van fossielbrandstowwe aangaan, die hoof sal moet bied.

Dus of ons daarvan hou of nie ons sal in 'n toenemende mate van ander energiebronne gebruik moet maak. Naas kern-energie sal sonenergie 'n baie belangrike rol moet inneem.

Ons stry dus nie oor olie, of steenkool of 'n paar moedswillige Arabiere nie. Ons praat oor ons eindige bronne van energie, hoe ons dit kan aanval en hoe ons dit die langste kan laat hou. Energiebesparing moet op 'n breë front aangegryp word. Op industriële gebied kan baie gedoen word en dit is waarskynlik die sektor waar die belangrikste bydraes gemaak kan word. Tans is daar sektore waar die koste van die energie bykans geen rol speel nie, daar ander kostes oorheers. Soos energie duurder gaan word sal hierdie nie noodwendig bly geld nie.

By die ontwerp van geboue en huise kan geweldig baie gedoen word om die energie benodig vir verwarming en verkoeling te minimaliseer deur korrekte ontwerp en veral benutting van die natuurlike omgewingsfaktore soos voorbeeld sonenergie.

Vir die privaat woonhuise is verwarming en verkoeling belangrik maar die beskikbaarheid van goeie same warm water het alreeds 'n aanvaarde norm geword.

Ek besef dat die gebruik van sonenergie vir waterverwarming vir die elektrisiteitsvoorsiener sekere probleme in verband met spitsaanvraag kan skep. Ek aanvaar ook dat dit op die kort termyn moontlike tariefverhogings kan teweegbring om die kapitaalbelegging te delg met 'n laer totale gebruik. Ek is eweneens oortuig dat ons metodes vir oorbrugging van hierdie besware sal moet vind. Alhoewel ons kan verwag dat tariewe vir die afsienbare toekoms slegs teen normale inflasiekoerse kan eskaleer, gaan die pretjie in elk geval anders lyk wanneer ons in die toekoms steeds laergraadse steenkool en kleiner afsettings sal moet benut.

Ons hou andag mikroprosessoreersders in naaimasjiene om mooi patroontjies te kan stik. Is dit regtig vergesog om te verwag dat ons aan die einde van die dekadde kan dink aan 'n mikrokonaar wat 'n energiebehoefte vir ons huise individueel kan beplan. Ons is gelukkig dat ons in verhitting- en verkoelingsisteme energie vir ure of selfs dae teen 'n redelike koste kan stoor in die vorm van warm en koue water, of ander geskikte stowwe. Met weerstateliete en numeriese weervoorspelling kan ons redelike kort-termyn voorspellings van 24 uur, 48 uur en selfs 72 uur doen.

Dit is dus myns insiens nie te vergesog om die piekvrug te antisipeer en vooruit obergang van warm of koue water te doen, eerder as om net laste af te skakel wanneer die krisis daar is nie. U sê hierdie stelsels gaan baie geld kos, ek gee toe. Die koste van primêre energie gaan ook baie kos!

Wat ek probeer sê mnr. die President, is dat ons sal moet vergeet om te kyk na byvoorbeeld die koste van elektriese krag alleen, maar na die totale koste van energie per gebruiker. Laat ons dus nie gate probeer skiet in voorstelle wat miskien op die kort termyn onekonomies lyk nie, maar laat ons hierdie positief reageer en probeer om die struikelblokke te oorkom.

Ek glo dat die VMEQ se bydrae tot hierdie komitee 'n baie belangrike een kan wees en sal wees, maar dan moet ons met 'n oop geemoed die heles saak benader, soos inderdaad ook deur mnr. Palser in sy verslag impliseer word. Dankie.

#### MR. J. GRUNDY: AFFILIATE

Surely these two items refer to the International Energy Agency, composed of 21 Nations? For example the British members of IEA are Sir Derek Ezra, chairman of the National Coal Board and Sir David Steel, Chairman of BP. The British Government Department of Energy spent nearly R5-million last year on wave energy research and they also gave the Camborne School of Mines in Cornwall R8-million to develop the technology of heat supplied by underground rocks. A small consortium got R700 000 to study the feasibility of a 60 metre diameter horizontal axis windmill and the North of Scotland Electricity Board put up a 22 kW wind generator in the Orkneys and are now thinking about a 2.3 MW job.

The Americans have passed a Wind Energy Systems Act to spend R680-million making wind mills. Of course the British Building Research Station is involved solar energy research as well as the CEBG and others. But overall coal appears to be prominent. The USA prohibit the building of new oil or gas fired boilers. Australia will give you a concession for putting in coal fired equipment. Japan will give you a grant or subsidy at a low interest rate. Fluidised bed combustion systems are being promoted. I think, as far as coal is concerned, the British say they have coal reserves for 300 years and, with the improvements in technology the reserves these will last very much longer. We might also consider Heat pumps, with great care. As a lighting man of course, I should say improve your lighting installations by our new technologies in lamps gear and luminaires and you'll save energy. Thank you.

#### MR. H. R. WHITEHEAD: DURBAN

Mr. President, the report deals with most matters arising from this subject, which is indicative of the thoroughness with which the Committee has dealt with the subject. One main point is that, for the supply authority, it is a heads you lose, tails you also lose, situation.

On a practical note though, although Durban has a reputation for sunshine, it is some what surprising that the solar radiation received annually in this region does not make solar heating a truly viable proposition in present state of the art. This fact has been borne out by an experiment carried out by our City Engineer's Department on two installations in the Durban Heights suburb, one having a solar assisted system and the other "control" dwelling having an equal capacity conventional water heating system.

The results showed an 18% saving on consumption of electricity which indicates that, unless there is a drastic reduction in capital cost and/or improved efficiency, the system is not a feasible proposition to the consumer. The Electricity Undertaking, however, in this instance where the Consumer would be saving R5,57 per month on a R30 per month bill, would only save R2,50 on our ESCOM account and to relate this to the presently improbable case of all domestic consumers having solar heaters we would experience a loss of income of R6 000 000/annum.

Nevertheless this is something with which we have to come to grips and the results of the work being done by the NBRI should be of invaluable assistance.

# REPORT OF THE NBRI STEERING COMMITTEE ON RATIONAL NORMS FOR TOWNSHIP SERVICES AND WORKING SUB-COMMITTEE FOR ELECTRICAL DISTRIBUTION

Natal Region — Mr. D. R. Hill (for Mr. D. H. Fraser)

Northern and Central Region — Mr. J. A. Loubser and Mr. A. H. L. Fortmann

The ESCOM representative, Mr. M. R. Padfiel, was chosen from the Western Cape Undertaking which has the largest percentage of ESCOM's urban consumers and thus has considerable practical experience in reticulating townships.

Representatives from both the NBRI (as Co-ordinator) and NEERI serve on this Committee in an advisory capacity.

The South African Association of Consulting Engineers (Electrical Section) has also been consulted for its comments and suggestions as and when required.

## 4. Work of the Electrical Working Subcommittee

The Electrical Working Subcommittee held its first meeting in March 1979 and has met 13 times since then and has produced the following:—

### 4.1 Statistics

A questionnaire was completed and returned by 58 local authorities, including ESCOM, throughout the Republic. The questionnaire covered the whole technical and financial field of township electricity supply.

### 4.2 Guidelines

The above information as well as the Cape Eastern and Transvaal Guidelines are being used as a basis in the preparation of these "Guidelines" for the design of electricity distribution networks in residential townships. The fourth draft of these has now been prepared for finalisation by the Working Subcommittee and submission to the Steering Committee via the Co-ordinating Committee for all five engineering services and for ultimate approval and adoption as a national guide for use in all the Provinces.

### 4.3 Cost Exercise

Each committee member was handed a drawing of a 304 erf "Sampleville" township and requested to determine the average cost per erf of reticulating the township, working completely independently, but within the same parameters.

The result of the exercise clearly indicated that the difference in total costs per erf of reticulating a township in the various Regions and by ESCOM was negligible and that the existing standards applied throughout the country could in fact be considered as being fairly uniform.

### 4.4 National Standardised Specifications for Electrical Engineering Work

In addition to the "Guidelines", National Standardised Specifications for Electrical Engineering Work (Electrical Township Distribution) are being prepared by the Working Subcommittee. These will be submitted to the SABS for approval and adoption as a national standard which is to be published in due course.

## 5. Future Work of the Electrical Working Subcommittee

All the Working Subcommittees have been requested to submit their "Guidelines" to the Co-ordinating Committee early in 1981 for final approval by the Steering Committee not later than May 1981.

This Co-ordinating Committee will in the meantime co-ordinate the "Guidelines" of the five Working Subcommittees and determine the final format of the combined document as well as the *modus operandi* for the administration and issue of the final document to the authorities concerned.

Work on the National Standardised Specifications will, however, have to continue until all the relevant documents have been finalised.

## 6. Conclusion

I wish to express my sincere appreciation to all the members of this Working Subcommittee for their efforts in this regard with special reference to the assistance given by the engineering staff of the Electricity Department of the Durban Corporation in the preparation of these "Guidelines" and National Standardised Specifications.

**J. K. VON AHLFTEN, AMEU REPRESENTATIVE ON THE STEERING COMMITTEE AND CHAIRMAN OF THE ELECTRICITY WORKING SUBCOMMITTEE**

## 1. Background

The Commission of Enquiry into Housing Matters (the Fouché Commission) investigated inter alia the increase in the cost of serviced land for residential township development. These services are:—

- Roads, Stormwater and Sidewalks
- Water Reticulation
- Sewage Reticulation
- Electrical Distribution
- Township Traffic and Transportation

The Commission found that the price of an erf in a private township development was determined mainly by market forces i.e. supply and demand and that the actual cost of the engineering services played a subordinate role. The Commission however made three important recommendations affecting these services which have been accepted by the Government:—

1.1 Township developers, whether private or local authorities, should be responsible for developing the township fully, including the financing and installation of all services.

1.2 To avoid purchasers having to pay twice for the same services in cases where the private township developer has already paid for the services in full and recovered the costs in its selling price, the local authority taking over the responsibility for the services would only be allowed to charge normal tariffs which would exclude any provision for capital expenditure.

1.3 Realistic standards or norms for services should be drawn up and applied country-wide, although rigid formulae and standards were not always possible to apply.

The NBRI was instructed to undertake the task, under the direction of the Department of Community Development, of establishing "Rational norms for Township Services" and to take the lead in finding acceptable and workable bases for facilitating the financing and installation of all services.

## 2. Steering Committee on Rational Norms for Township Services

To implement the Fouché Commission recommendations, the National Building Research Institute was requested to collaborate with other appropriate bodies and the Provincial Administrations in the preparation of uniform national and functional norms in respect of engineering services for new residential townships.

A Steering Committee was subsequently formed and five Working Subcommittees were established to cover the engineering services mentioned in paragraph 1.

The responsible authorities should then take positive steps to ensure that the norms are applied in both public and private township development throughout the country. The intention is that no new township plan will be approved in future unless an "engineering" certificate of compliance with these norms accompanies such a plan.

## 3. Working Subcommittee for Electrical Distribution

The National Building Research Institute requested the AMEU to set up a Working Subcommittee for electrical distribution under the Chairmanship of Mr. J. K. von Ahlften.

This Sub-Committee was required to consist of technical representatives of all the Provinces in the country including the Electricity Supply Commission and for this purpose the Regions of the AMEU are represented by the following AMEU members, who are responsible for feedback of information from and consultation with the Regions:—

Cape Western Region — Mr. K. J. Murphy (for Mr. D. C. Palsler)

Cape Eastern Region — Mr. J. D. Dawson



## DISCUSSIONS BESPREKINGS

### MR. J. D. DAWSON: UITENHAGE

As is evident from the title of the NBRI Steering Committee, the Working Sub-committee's prime directive was to produce a set of national norms or guidelines for the design or electrical distribution systems for residential townships.

To illustrate the work of the Sub-committee, I would like to comment on two issues which caused considerable discussion. The first was what the declared voltage should be in respect of the supply to consumers in residential townships and what percentage variation should be allowed to this voltage.

Regulation 24 of the Electricity Act states that for pressures below 600 volts the standard pressures at consumers' terminals shall be 220/380 volts for three phase alternating current systems and the pressure at which electricity is supplied shall not differ from this standard pressure by more than 5 per cent for a longer period than ten consecutive minutes.

However at the IEC meeting held in Sydney in 1980, a World standard of 230/400 volts with an allowable variation of  $\pm 10\%$  was accepted and was initially considered very favourably by the Committee because the capital cost of a distribution system based on these parameters would be considerably less than one based on the present limitation.

However the Sub-committee finally recommended in the "guidelines" that the design of townships should be based on a voltage at the consumer's point of supply of  $230\text{ V} \pm 5\%$  for the following two major reasons:—

1. Many items of electrical equipment used by consumers in domestic residential areas, particularly small motors, could be severely affected by a  $\pm 10\%$  voltage variation and might possibly fail.
2. Although the IEC has recommended a  $\pm 10\%$  variation this is really meant as an interim measure to incorporate at this stage as many of the existing national standard voltages as possible and this allowable variation range will be reduced in the future.

The second issue arises directly from the first and that is the point as which the standard voltage should apply.

The Electricity Act refers to the "consumer terminals" and to most undertakings in South Africa this is taken to mean the outgoing terminals of the electricity meter.

However, in residential townships, the consumer's meter may be inside the house or on the outside wall of the building or on the boundary of the erf or possibly even in a kiosk situated some distance down the street.

The design of the reticulation system will therefore vary depending on the point at which it is necessary to maintain the standard voltage.

The present day practice in South Africa in so far as other municipal services, such as water, are concerned is tending to the concept that everything inside the consumer's erf is his responsibility.

The Working Sub-committee therefore decided to accept this principle for design purposes and has defined the point of supply as that point where the electricity supply crosses a consumer's boundary irrespective of where the metering is installed.

The Sub-committee considered that this would ensure a common base for design purposes and this is considered even more important than any argument that may be advanced that it must be possible to physically separate and measure the voltage at the point of supply.

Finally Mr. President I would like to make it clear that the guidelines are not only the product of the ideas of the small number of Electrical Engineers who make up the Sub-Committee but instead, as the Committee has sought information and constructive comment from the majority of electricity undertakings throughout the Republic, the final document represents the practices and systems which have been proven by long experience as the best for South African conditions.

I believe that the guidelines will be of service and benefit to all who make use of them in the future. Thank you.

### MR. MIKE DOYLE: AFFILIATE

Mr. President, I do fully appreciate that the last thing you want in your very stretched agenda, is an argument on the use of earth leakage, but the controversy seems to have come about since the work that we have just heard about done by the NBRI. In fact a report that they published seemed to have started the whole thing. That is why I feel it is appropriate at this stage. The basic objections, as we heard this morning, appear to be cost, (a nuisance) and I would like to suggest that the delegates of this conference consider earth leakage protection as an insurance policy which, of course, it is and when one looks at the cost of a house of say R10 000, which is a very small house, but possibly related to low cost housing, the cost of the earth leakage at R50 is a one stop payment at something like 0,05 per cent.

Mr. President, house insurance in Johannesburg at this stage costs about R10 per R1 000 of the contents of the property. I would just like to pose the question of how many delegates here pay for household insurance. I would suggest Mr. President, with respect, that it is something like 95 per cent if not 100 per cent. Then I ask the next question. How many have had a substantial burglary and have continued to pay this money? I think we must get this into some sort of perspective. To remove earth leakage legislation, which seems to be the intention of some delegates, would be in my opinion a backward step. Although not mandatory in most countries, sales are increasing substantially and it is clear, when one looks at amendments to overseas codes, that they are moving more and more in that direction. The argument has also been put that we are not against earth leakage but it should be left to the consumer to determine his own destiny and to spend his money in the way he wants to.

Mr. President, nobody likes his right of choice circumscribed by too much legislation. However, should we make the following optional: Third party motor insurance for instance, road worthy test for instance or, Mr. President, to really stretch the point, should we make heroin and other hard drugs available tomorrow if the consumer wants them? Of course the answer is no. The NBRI report said that we only kill 2,75 persons per million per year through electrocution. Related to Soweto and the electrification programme, that means that we kill 3 people per year. Can we, as professional people, morally accept that responsibility without taking the necessary action?

As a result of an interview given by Tony McDonald, as President of ECA, to a newspaper in the Transvaal recently, we saw some pretty frightening figures which really floored us. So what we did was, we went out and did a very random survey, which covered our product as well as that of a competitive, and one of the questions we asked householders was — have you ever had an electric shock which tripped your earth leakage. Some said once, some said twice, others said yes, four times. According to the answers Mr. President, we found that 16 per cent of those interviewed had had this experience. The other thing about statistics is that as long as it is not happening to you, 2,75 per million is not a very high figure. Somebody said yesterday at the conference that, in the Randburg area very recently, the father of a 15 year old girl was electrocuted — no earth leakage in the house — his statistic is now 100 per cent and that is what we must look at. Mr. President, in conclusion, if the law is changed by opinion, we are one step ahead in the world in this regard and if we change the situation now, we are taking a backward step. Thank you.

### MR. J. C. VAN ALPHEN: SABS

Gentlemen, one comment on that 230 volt supply. The position is that at the moment there are standardised 220 and 200 volt systems. Many of the equipment specifications are for these voltages and the IC is still not sure if 230 is the right choice. In many countries in Europe there is not a single thought of changing from their present system because it would cause a terrific upheaval in all the apparatus installed as well as apparatus from abroad. I think we should be very careful, Mr. President, in changing from the standard which is accepted by the AMEU representatives on the committee.

#### MR. K. E. ROBSON: EAST LONDON

Mr. President, taking the point that Mr. van Alphen has made, it's my impression that the AMEU has officially adopted, following a request of the SABS, the voltage of 230 plus or minus 10% ultimately. But perhaps Mr. van Alphen might correct that, if I am wrong.

#### MR. A. A. MIDDLECOTE: SABS

Mr. van Alphen is trying to come to the right point. There is difficulty for Apparatus Committee's, and naturally they will be careful, but the lead has been taken from the IEC which has decided quite definitely that the direction is towards 230 Volts. There is no doubt that there are difficulties. Britain is a little hazy about it because she changed from 220 to 240 and she does not want to come back, but emotionally continentals are quite happy because in fact they very like Municipal Engineers in South Africa. Their actual voltage is never the same as the declared standard. I think the long-term view accepted by AMEU has been to follow a planned changeover to 230 for the standard voltage. Thank you.

#### MR. L. E. HUNT: WHITE RIVER

In connection with township services as a whole, I think it is fair to say that the cost of services is more or less in proportion to the road frontage. And when you have a design of township where the road frontage is high in relation to the area of the stands you are going to get a high cost of services. I have prepared two little sketches that I have handed to you. The one shows that for Durban the services for a 30 x 50 metres site laid out in one way could cost say R4 000, whereas if laid out the other way they could cost R5 600 pererven. The cost of the services as a whole is very much in relation to the layout of a township. Thank you.

#### CSIR/NBRI ADVISORY COMMITTEE/ WNNR/NBHI -ADVIESKOMITEE

#### MR. P. J. BOTES: ROODEPOORT

Mnr. die President, as gevolg van my vertoë in my presedentsre by die vorige Konvensie oor beter samewerking op die gebied van son- en elektriese energie is 'n brief van die eertydse Direkteur van die Bounavorsingsinstituut Dr. T. L. Webb ontvang waarin hy sy dank uitspreek teenoor die werk wat die VMEO doen veral in die persoon van mnr. J. K. von Ahlfen met betrekking tot nuwe bedradingsstelsels.

Hy het ook die VMEO uitgenooi om 'n verteenwoordiger te benoem op die Bounavorsingsadvieskomitee. Hierdie komitee waarop alle belanghebbende instansie in die bougemeenskap verteenwoordig is, vergader kwartaaliks en dien om die NBNI van die nodige advies te bedien wat die navorsingsprogram betref.

Die Uitvoerende Raad het myself en mnr. J. K. von Ahlfen as alternatief aangewys op hierdie komitee. Sedertdien is 4 vergaderings gehou waarvan ek en mnr. von Ahlfen die eerste twee bygewoon het. Die ander twee kon ons weens dringende werksomstandighede nie bywoon nie. Sake wat bespreek is, is die verpligte installering van aardkredels, die internasionale standardisering van sok- en uitgangproppe en sake aangaande die gebruik van son- en elektriese energie.

Dit is noodsaaklik vir die VMEO om op hierdie komitee te dien en te dien as 'n skakel vir samewerking om sekere uiteenlopende gedagtes, veral die een wat betrekking het op die gebruik van sonenergie en besparingsvoorstelle oor elektriese energie in verband met mekaar te bring. Dankie.

# Bestuur met Super Rand



## BANKOVS—

MET TOTALE BATES VAN BYKANS R400 MILJOEN IS ONS GROOT GENOEG OM U HELE BELEGGINGSPORTEFEULJE TE HANTEER. EN KLEIN GENOEG OM PERSOONLIKE DIENS TE LEWER. U PRAAT DIREK MET BANKOVS SE TOPAMPTENARE — EN KRY BESLUIE SONDER VERTRAGINGS.

Bankovs se Super Rand-Plan is u antwoord.

- ★ KOMPETERENDE RENTEKOERSE
- ★ PERSOONLIKE DIENS IN U KANTOOR
- ★ U BEHOU KONTINUITIEIT MET U PERSOONLIKE BANKIER
- ★ ONS LEWER DEPOSITOSERTIFIKATE EN RENTETJEKS PERSOONLIK AF — BETYDS
- ★ ONS BESOEK U SELFS NÁ NORMALE SAKE-URE

**BANKOVS**  
Verander u Rand na Super Rand

BANK VAN DIE ORANJE-VRYSTAT BEPERK N DEURSCHEIDINGDE ALLEMOE WANK

Informatie

# REPORT ON THE SOUTH AFRICAN NATIONAL COMMITTEE ON ILLUMINATION

This report covers the activities of SANCI for the two years 1979 and 1980.

Twenty-Sixth Annual General Meeting And Congress — 1979:

The twenty-sixth annual general meeting and congress, with the theme, "Design Criteria For Lighting The Environment", was held at the CSIR Conference Centre, Pretoria, from 5 to 7 November 1979.

The President, Mr. J. K. von Ahlften, was in the chair and Dr. T. L. Webb, Director, NBRI, CSIR, presented the official opening address.

In the opening address by Dr. Webb, the aspect of energy saving figured prominently.

In his presidential address, Mr. J. K. von Ahlften also referred to energy saving, but covered mainly activities of SANCI, making reference to certain people, as well as to membership of SANCI and attendance at SANCI annual general meetings and congresses by municipal members.

The following papers were read and discussed: —

1. "Developments in lighting and computer-aided lighting design" by Prof. Dr. D. Fisher, Philips, Eindhoven, Netherlands.
2. "New cost saving ideas for outdoor lighting" by Dr. R. Walther and Mr. H. Wulf, BAG Turgi, Switzerland.
3. "Design for visibility" by Dr. H. D. Einhorn, Consulting Engineer, Cape Town.
4. "The implementation of CIE 12/2 in national codes of practice" by Mr. P. Hartill, Phosco Ltd., United Kingdom.
5. "Problems related to TV lighting in South Africa" by Mr. W. L. Wilmans, Siemens SA and Mr. N. A. L. Allen, SABC.
6. "Emergency lighting: In search of a code of practice" by Mr. D. N. Lee, Lascon Lighting Industries.
7. "The use of small programmable pocket calculators in lighting design" by Mr. M. J. F. Dempster, ESCOM.
8. "Light fittings and the Electrical Contractors" by Mr. C. E. Gaynor, Ernest Gaynor & Co. (Pty.) Ltd.
9. "A review of the CIE guide viz. a viz. the SABS code" by Mr. D. W. Young, Litespec, Africa.

A forum session was held, chaired by Mr. L. O. Foster.

After his two-year period in office as President, Mr. J. K. von Ahlften relinquished this post and tribute is paid to him, because as one of our AMEU members, he kept the "AMEU flag flying high". Credit must also go to Mr. Von Ahlften for his seemingly inexhaustible supply of energy which he was able to pour into SANCI matters besides the numerous other AMEU working committees he is charged with and/or serves on.

Mr. L. O. Foster was elected as President with Mr. C. J. Kok as Senior Vice-President and Mr. J. Smith as Second Vice-President.

The CSIR Conference Centre was an ideal venue for this congress, which was very well organised and congratulations to the Secretary of SANCI for a job well done.

Twenty-seventh Annual General Meeting And Congress — 1980:

The twenty-seventh annual general meeting and congress, with the theme, "Lighting Strategies In The 80's", was held at the Blue Waters Hotel, Durban, from 25 to 27 August 1980, and the President, Mr. L. O. Foster, was in the chair.

The congress was officially opened by His Worship, the Mayor of Durban, Councillor H. Bradford.

In his presidential address, Mr. L. O. Foster touched briefly on some noteworthy happenings of the past number of decades. Once again, however, the main theme covered the energy aspect — something that has figured prominently at previous congresses. Mr. Foster suggested that lamp and

# VERSLAG OOR DIE SUID-AFRIKAANSE NASIONALE KOMITEE VIR VERLIGTING

Hierdie verslag dek die bedrywighede van SANKV vir die twee jaar — 1979 en 1980.

Ses en Twintigste Algemene Jaarvergadering En Kongres — 1979:

Die ses en twintigste algemene jaarvergadering en kongres, met die tema "Design Criteria For Lighting The Environment", was by die Konferensiesentrum, WNNR, Pretoria, van 5 tot 7 November 1979, gehou.

Die President, Mnr. J. K. von Ahlften, het voorgesit en Dr. T. L. Webb, Direkteur, NBRI, WNNR, het die amptelike openings toespraak gelewer.

In sy openingsrede het Dr. Webb van die besparing van krag melding gemaak.

In sy Presidentsrede het Mnr. J. K. von Ahlften ook na kragbesparing verwys, maar het hoofsaaklik die bedrywighede van SANV, met ver wysing na sekere persone, sowel as lidmaatskap van SANKV en bywoning deur munisipale lede van die jaarlikse algemene vergaderings in kongresse, gemeld.

Die onderstaande lesings was voorgelees en bespreek:—

1. "Developments in lighting and computer-aided lighting design" deur Prof. Dr. D. Fisher, Philips, Eindhoven, Nederland.
2. "New cost-saving ideas for outdoor lighting" deur Dr. R. Walther en Mnr. H. Wulf, BAG Turgi, Switzerland.
3. "Design for visibility" deur Dr. H. D. Einhorn, Raadgevende Ingenieur, apstadeur.
4. "The implementation of CIE, 12/2 in national codes of practice" deur Mnr. P. Hartill, Phosco Ltd., Verenigde Koninkryk.
5. "Problems related to TV lighting in South Africa" deur Mnr. W. L. Wilmans, Siemens, SA en Mnr. N. A. L. Allen, SAUK.
6. "Emergency lighting: In search of a code of practice" deur Mnr. D. N. Lee, Lascon Lighting Industries.
7. "The use of small programmable pocket calculators in lighting design" deur Mnr. M. J. F. Dempster, EVKOM.
8. "Light fittings and the Electrical Contractors" deur Mnr. C. E. Gaynor, Ernest Gaynor & Co. (Pty.) Ltd.
9. "A review of the CIE guide viz. a viz. the SABS code" deur Mnr. D. W. Young, Litespec, Africa.

'n Forum, onder voorsitterskap van Mnr. L. O. Foster was gehou.

Na sy termyn van twee jaar as President, het Mnr. J. K. von Ahlften die pos neergelê en hulde word aan hom betoon as een van die VME0-lede, wat die "VME0-vlaggie" hoog laat wapper het. Erkenning moet ook aan Mnr. Von Ahlften geskied vir sy skynbare onuitputlike werkvermoë wat hy benevens vele ander VME0-komitees wat onder sy beheer was of waarop hy gedien het, ook aan SANKV beskikbaar kon stel.

Mnr. L. O. Foster was as President verkies met Mnr. C. J. Kok as Senior Vice-President en Mnr. J. Smith as Tweede Vice-President.

Die wêreldbekende WNNR Konferensiesentrum was 'n ideale plek van byeenkoms vir hierdie kongres, wat baie goed georganiseer was en gelukwense vir 'n taak welgedaan, -kom aan die Sekretaris van SANKV toe.

Sewe en twintigste Jaarlikse Algemene Vergadering En Kongres — 1980:

Die sewe en twintigste jaarlikse algemene vergadering en kongres, waarvan "Lighting Strategies In The 80's", die tema was, was by die Blue Waters Hotel, Durban, van 25 tot 27 Augustus 1980 gehou. Die President, Mnr. L. O. Foster, was die Voorster.

Die kongres was amptelik deur Sy Agbare, die Burgemeester van Durban, Raadslid H. Bradford, geopen.

In sy presidentsrede het Mnr. L. O. Foster kortliks sommige noemenswaardige gebeure van die afgelope paar dekades aangestip. Soos by vorige kongresse, was energieaspek weer genoem. Mnr. Foster het aan die hand gedoen dat lamp- en toerustingvervaardigers meer verantwoordelikheid vir die navor-

equipment manufacturers have greater responsibilities to research more efficient light sources, luminaires and control equipment.

The following papers were presented at the congress:—

1. "New aspects to street lighting" by Mr. J. Bosarke, Siemens, Ltd., Erlangen, West Germany.
2. "International rules for electrical installations" by Mr. A. A. Middlecote, Deputy Director General, SABS.
3. "Some southern african expertise in exterior lighting" by Mr. J. T. Grundy, Phosware Ltd., Springs.
4. "The practical lighting engineer" by Mr. W. K. Lumsden, Thorn Lighting (Pty.) Ltd.
5. "The CIE and SANC1's role in its activities" by Mr. R. S. Yates, Johannesburg City Council.
6. "Radiation and some of its important aspects in agriculture" by Mr. M. J. Savage, University of Natal.
7. "Office lighting — a rethink" by Mr. D. N. Lee, Lascon Lighting Industries (Pty.) Ltd.
8. "Recent developments in daylighting" by I. H. Boyd, NBNI, CSIR.
9. "School lighting — a new approach" by Dr. H. D. Einhorn, Consulting Engineer.
10. "A production version of a locally developed radiometer/photometer" by Dr. F. Hengstberger, NPRL, CSIR.

Once again a forum session was held, chaired by Mr. A. N. Chalmers.

Mr. L. D. Foster was re-elected President, Mr. C. J. Kok Senior Vice-President and Mr. J. W. Smith Second Vice-President.

Messrs. J. L. F. H. Delpert, Edenvale and J. J. Boshoff, Vanderbijlpark, two AMEU members, were co-opted to the Executive Sub-Committee.

The meeting considered and approved a 15% increase in subscription rates for the coming financial year. The congress was of a very high standard, well conducted and organised.

On the social side the Durban Corporation gave a cocktail party and on another evening a cocktail party on a ferry trip was sponsored by a number of companies. The evening included a visit to the container terminal in the Durban harbour.

sing vir meer doeltreffende ligbronne, armature en beheer-voering op hulle behoort te neem.

Die onderstaande lesings is aan die kongres voorgelê:—

1. "New aspects to street lighting" deur Mnr. J. Bosarke, Siemens, Ltd., Erlangen, Wes-Duitsland.
2. "International rules for electrical installations" deur Mnr. A. A. Middlecote, Adjunk Direkteur-Generaal, SABS.
3. "Some southern african expertise in exterior lighting" deur Mnr. J. T. Grundy, Phosware Ltd., Springs.
4. "The practical lighting engineer" deur Mnr. W. K. Lumsden, Thorn Lighting (Pty.) Ltd.
5. "The CIE and SANC1's role in its activities" deur Mnr. R. S. Yates, Stadsraad, Johannesburg.
6. "Radiation and some of its important aspects in agriculture" deur Mnr. M. J. Savage, Universiteit van Natal.
7. "Office lighting — a rethink" deur Mnr. D. N. Lee, Lascon Lighting Industries (Pty.) Ltd.
8. "Recent developments in daylighting" deur I. H. Boyd, NBNI, WNNR.
9. "School lighting — a new approach" deur Dr. H. D. Einhorn, Raadgewende Ingenieur.
10. "A production version of a locally developed radiometer/photometer" deur Dr. F. Hengstberger, NBNI, WNNR.

'n Forum, onder voorsitterskap van Mnr. A. N. Chalmers, is gehou.

Mnr. L. O. Foster is as President herkies. Mnr. C. J. Kok as Senior Vice-President en Mnr. J. W. Smit as Tweede Vice-President.

Mnre. J. L. F. H. Delpert, Edenvale en J. J. Boshoff, Vanderbijlpark, twee VME0-lede, is as bykomende lede van die Uitvoerende Onderkomitee gekoopteer.

Die vergadering het 'n 15%-verhoging in lededag vir die komende finansiële jaar oorweeg en goedgekeur. Die kongres was van 'n baie hoë peil, goed georganiseer en gelei.

Wat ontspanning betref, het die Durban Stadsraad 'n skemerpartytjie aangebied en op 'n ander aand was 'n skemerpartytjie op 'n veerbootvaart deur 'n aantal firmas aangebied. Die aand het 'n besoek aan die houer-eindput by Durban se hawe ingesluit.

#### A. H. L. FORTMANN REPRESENTATIVE/VERTEENWOORDIGER

## DISCUSSIONS BESPREKINGS

### MR. J. GRUNDY: AFFILIATE

On behalf of SANC1, I am the Chairman of the CIE Affairs Committee. SANC1 operates on a very low budget indeed, supported by so few. Hence SANC1 welcomes indeed all the support it can have from the AMEU. Arising from the Kyoto Quadrennial has come proposals to revise the CIE. These proposals and some of my comments are being published in the Journal Vector, both in serious and humorous terms. Led by my colleague Mr. Foster and accompanied by Dr. Hengstberger the Honorary Secretary, with Mr. Dempster and Dr. Einhorn, this small South African delegation departs for the CIE mid Quadrennial meetings in Granada Spain this week. Very briefly the two major points which this delegation has to put forward are:—

1. South Africa does not accept the proposal of the Action Committee being composed of Chairmen of the 8 to 10 Technical Committees, those Chairmen being elected by the Technical Committees. The Action Committee should be formed by invitation or rotation of Countries.
2. No CIE Quadrennial has ever been held south of the Equator, nor has any President been from south of the Equator. As members of CIE are Australia, New Zealand,

South Africa and Argentina in the southern hemisphere and invitations were issued by Australia and South Africa to hold the 1987 Quadrennial in their countries. Hence it should go to a vote as to where the venue should be.

In regard to W.G.7, it is worth noting that there does not appear to be in existence a standard for low voltage operated luminaires such as are installed in caravans, boats, trains, public service vehicles etc. One has to rely on the good sense and practice of certain companies and authorities. VCL 2001: 1980 has now been published. It makes use of those parts of certain existing Standards relevant to the lighting products covered, e.g. transistorised ballasts for fluorescent lamps, IEC 598 and BS 4533 (2nd edition in the UK) modified as necessary for the particular applications of vehicle/caravan lighting. Although the battery voltage involved in lighting of this type is only up to 48V DC, much higher voltages can exist within the equipment. This VCL 2001 will require much improved protection against electric shock and the effects of heat and the luminaires themselves should not contribute to the fire risk. Under VCL 2001, the mechanical strength — the luminaire's ability to withstand the physical knocks and movement it can reasonably be expected to encounter — is specified and has to be tested. In these "consumerist" times

we are all becoming increasingly aware of the areas where consumers can be at risk. Low Voltage lighting in vehicles is certainly one area and one would hope that VCL 2001 will have the effect of upgrading all such lighting to the highest levels of safety, performance and construction.

In regard to W.G. 12, IEC 598 Luminaires makes it quite clear that insulation requirements of wiring rules are not incorporated in the Specification, and that the Committee is

of the opinion that requirements relating to the construction of luminaires should not appear in Wiring Regulations. The arguments really relate to the accessibility of basic insulation in ceiling voids. IEC 598 Part 1 covers protection against electric shock and marking and provision of installation instructions which, if obeyed, are adequate. The problem can arise where, with certain luminaires used in suspended ceilings, their wiring comes outside the body of the luminaire. In these instances, where the ceiling void is accessible to non-electrically skilled personnel, one would suggest that wiring having only basic insulation should be protected by sheathing or enclosure of the wiring or the complete luminaire. Such problems as are apparent with Downlighters can occur with fluorescent luminaires recessed into suspended ceilings, where the lamps protrude beyond the ends of the luminaire bodies, since basic insulation only is provided on the leads to the lampholders. In such cases one would consider such luminaires

unsuitable for installation into voids accessible to other than electrical personnel unless further precautions were specified. Thus the vital need is for compatibility at the interface of a luminaire in relation to the installation wiring.

In regard to both W.G. 12 and 13, if insulation resistance tests are to be carried out on the wiring to the mains supply or to the output circuits to the luminaires, it is very advisable to make disconnections prior to the tests rather than just removing the lamps. The Wiring Regulations should make it entirely clear as to the correct method of test which avoids any breakdown of electronic components incorporated, as is done overseas. Arguments seem to arise as regards earth bonding requirements for luminaires in suspended ceilings. It is open to some question as to whether an integrated ceiling assembly should be carbonbed provided the luminaire and all suspended electro-mechanical plant is earthed correctly and directly. Thank you.

## REPORT ON THE ACTIVITIES OF THE AMEU/ILESA/SANCI STREET LIGHTING ADVISORY COMMITTEE

This report covers the activities of the AMEU/ILESA/SANCI Street Lighting Advisory Committee.

On 28 February 1978 a symposium entitled "Practical and Economic Road Lighting" was held in Johannesburg. This symposium was a joint project of the AMEU, ILESA and SANCI. During the discussion period it became evident that the participants felt that a lot of common problems could be alleviated if a special committee could be formed to investigate these problems. As a result two members of each of the three organisations were appointed to form the new "Street Lighting Advisory Committee". The appointed members are as follows:—

AMEU, Messrs. J. K. von Ahlfen and A. H. L. Fortmann  
ILESA, Messrs. J. Grundy and R. Yates  
SANCI, Messrs. H. Steyn and A. Claasen

At its first meeting, the committee agreed to draw up guidelines on all aspects of street lighting which would be distributed by each organisation to its members. The guidelines would be compiled with the assistance of outside experts in the various fields and published as and when they were completed.

Good progress has been made with the various projects and some are virtually complete.

The guidelines are split up into nine projects, as follows:—

- Project 1: Poles
- Project 2: Luminaires
- Project 3: Lamps and Control gear
- Project 4: Maintenance
- Project 5: Incentive and Economics
- Project 6: Reticulation
- Project 7: Personnel and Safety Requirements
- Project 8: Training
- Project 9: Design Parameters

The next meeting is scheduled for 11 February 1981 (date of this report — 12 January 1981), when it is expected, inter alia, to make a decision on binders, printing, etc. The question of costs will also have to be resolved.

One aspect of the work of this Committee which should be of interest to all concerned in the installation and maintenance of street lighting equipment, is the enormous amount of help willingly given by the Department of Manpower Utilisation. Firstly, the regulations relating to the operation and safety of high mast lighting equipment are not clearly defined in the Factories, Machinery and Building Work Act and Regulations and, as a result, this was discussed with the Chief Inspector of Factories and draft recommendations have been drawn up. This draft covers all aspects of safety of components and lists standard and special procedures for ensuring safe operation of the raising and lowering equipment as well as the type of records which will need to be kept.

## VERSLAG OOR DIE BEDRYGWIGHEDE VAN DIE VMEO/IVISA/SANKV STRAATVERLICHTING ADVISE- RENDE KOMITEE

Hierdie verslag dek die bedrywigheid van die VMEO/IVISA/SANKV Straatverligting Adviseerende Komitee.

'n Simposium, getiteld "Practical and Economic Road Lighting" was op 28 Februarie 1978 te Johannesburg gehou. Dit was 'n gesamentlike projek van die VMEO, IVISA en SANKV. Tydens die besprekings het dit duidelik geword dat die deelnemers die mening toegedaan is dat 'n spesiale komitee, wat vir die doel saamgestel behoort te word, baie van die probleme kan ondersoek en op die manier die taak vergemaklik. Gevolglik was twee lede van elk van die drie organisasies aangestel om die nuwe "Straatverligting Adviseerende Komitee" te vorm. Die aangestelde lede is soos volg:—

VMEO, Mnr. J. K. von Ahlfen en A. H. L. Fortmann  
IVISA, Mnr. J. Grundy en R. Yates  
SANKV, Mnr. H. Steyn en A. Claasen

By die eerste vergadering het die komitee ooreengekom om riglyne oor alle benaderings in verband met straatverligting op te stel en dit dan deur elke organisasie aan sy lede te laat uitdeel. Die riglyne sou met behulp van eksterne deskundiges in die verskillende rigtings saamgestel word en, wanneer dit gereed is, gepubliseer word.

Goeie vordering is met die verskeie projekte gemaak en sommige is so te sê afgehandel.

Die riglyne is in nege projekte soos volg opgedeel:—

- Projek 1: Pale
- Projek 2: Armature
- Projek 3: Lampe en beheertoerusting
- Projek 4: Instandhouding
- Projek 5: Aansporing en ekonomiese oorwegings
- Projek 6: Henetting
- Projek 7: Personeel en Veiligheidsvereistes
- Projek 8: Opleiding
- Projek 9: Ontwerpparameter

Die volgende vergadering is gereël vir 11 Februarie 1981 (datum van hierdie verslag — 12 Januarie 1981), wanneer verag word om, onder andere, te besluit oor die uitgawe van drukwerk, bind, ens., daarvan.

Wat hier genoem moet word in verband met die werk van die Komitee is almal wat by die installasie en instandhouding van straatligtoerusting betrokke is, is die baie en gewillige hulp van die Departement van Mannekragebenutting.

Eerstens, is die regulasies betreffende die werking en veiligheid van hoëmasttoerusting nie in die Wet op Fabriek, Masjinerie en Bouwerk, duidelik omskryf nie. Gevolglik is dit met die Hoofinspekteur van Fabriek bespreek en is konsep-aanbevelings opgestel. Dit dek alle benaderings oor die veiligheid van onderdele, standaard en spesiale werkmodes by die hys en neerlaan van toerusting, sowel as rekords wat gehou moet word.

Secondly, it has long been felt that, with proper training, lamp replacers could be permitted to replace and/or carry out repairs to other street lighting components. With the help of the Chief Inspector of Factories, a draft has been compiled regarding exemptions to be granted from the provisions of Regulation C51 (1) and (2) in which the work limits and training necessary have been defined.

Another development from the work of the Committee which is worth recording, is the compilation of a "Lamp Fault Tracing Chart". This is intended for distribution to electricians and lamp replacers and, if followed, will lead to quicker and more effective fault location on street lighting equipment. We look forward to the publication of the first data sheets which, it is hoped, will be very soon.

**A. H. L. FORTMANN**  
**REPRESENTATIVE/VERTEENWOORDIGER**

**MR. A. H. L. FORTMANN: BOKSBURG**

Mr. President, some 4 of the 9 projects have been completed and the others are nearing completion. So there is good progress here and we have got to look into the matter of printing. It looks as if it could be in the magazine "Vector" that these projects will be printed, but that is still being investigated. Thank you.

**MR. J. GRUNDY: AFFILIATE**

I am responsible in that Committee for the drafts on Luminaires and Lamps and Control Gear. For the Luminaires we can turn to the SABS in part, but we have to bear in mind that the SABS seems to take no cognisance of IEC 598. In fact the SABS was never sent overseas for comments as is customary practice. When I come to lamps, well SABS 56-1961 is going to be revised, one would hope with some attention being paid to BS 5971 and the revisions likely of

**REPORT ON THE CIE 19th SESSION**  
**HELD IN KYOTO, JAPAN,**  
**AUGUST 1979**

The 19th Session of the CIE was held in the beautiful city of Kyoto, Japan. Mr. J. von Ahlfen attended the conference entirely at the expense of SANCI.

Mr. R. S. Yates, Lighting Engineer of the Johannesburg City Council, and well known by many AMEU members, also attended the CIE Session.

Numerous technical committees held working meetings and two, which are probably of interest to AMEU members, are reported on below.

Technical Committee 4.9: Lighting Economics and Technical Committee 4.6: Road Lighting, were attended by Messrs. J. von Ahlfen and R. S. Yates, respectively.

Reports on the activities of these Technical Committees were submitted to the 1979 SANCI Congress in Pretoria and are repeated here for the benefit of AMEU members in English.

**\*1. Technical Committee TC 4.9: Lighting Economics**  
**Chairman: J. Svehla**

**Secretariat Country: Czechoslovakia**

**1.1 Scope and past work**

During the 1975 London CIE Session the draft of Study Group C was approved for the establishment of a new Technical Committee 4.9 — Cost benefit relationships in Lighting — with the following terms of reference:—

- (a) future development of lighting and forecasts including cost benefit relationships in lighting, and

Tweedens is lankal reeds gevoel dat, met behoorlike opleiding, straatlampbedieners toegelaat behoort te word om ander straatligtoerusting ook te vervang en/of te herstel. Met behulp van die Hoofsinsteur van Fabriek is 'n konsep in verband met vrystellings van die bepaling van Regulasie C51 (1) en (2), waarin perke en opleiding voorgeskryf word, opgestel.

'n Ander uitvloeisel uit die werk van die Komitee is die opstel van 'n "Foutiewe Lamp Opspoorlys". Die doel is om so 'n lys aan elektrisiers en straatligbedieners te gee om sodoende gouer en meer doeltreffend gebreke te kan opspoor.

Ons sien uit na die publikasie van die eerste datalyste wat binnekort verweg word.

IEC 432. It seems better to use IEC Publication 82 for Ballasts and it is worth noting that IEC 662 has been issued for HPSO lamps which covers both American and European lamp types, probably to the relief of many SA users. Overall, a lamp draft is very difficult in so much as on the SA market there are American, British Dutch and Japanese discharge lamps to name a few.

Returning now to SANCI, as Mr. Fortmann may have pointed out, the AMEU-ILESA and SANCI gave to the NTRRL a small sum of money in 1978 to study South African road surfaces, such vital information being needed in order to calculate road luminance values by the CIE 12/2 method. The personnel of the NTRRL have done their work well, perhaps the surprising thing is the variety of road surfaces from Pretoria to Durban and Cape Town to name but a few. Nevertheless members of the NTRRL are presenting a Paper at the SANCI AGM in October in Cape Town, which we hope will encourage AMEU Members to attend. Thank you.

**VERSLAG OOR DIE CIE 19de SESSIE IN**  
**KYOTO, JAPAN, GEDURENDE**  
**AUGUSTUS 1979**

Die 19de Sessie van die CIE was in die mooi stad Kyoto, Japan, gehou. Mnr. J. von Ahlfen het die konferensie, waarvan die onkoste geheel-en-al deur SANKV gedra was, bygewoon.

Mnr. R. S. Yates, Verligtingsingenieur van Johannesburg se Stadsraad, en welbekend aan baie lede van die VMEO, het ook die CIE-sessie bygewoon.

Talle tegniese komitees het werksvergaderings gehou en oor twee wat moontlik vir VMEO-lede van belang mag wees, word hier verslag gegee.

Tegniese omitee 4.9: Ekonomie by Verligting en Tegniese omitee 4.6: Verligting van Paale, was deur Mnr. J. von Ahlfen en R. S. Yates onderkeidelik bygewoon.

Verslae oor die bedrywighede van hierdie Tegniese Komitees was aan die 1979 SANKV Kongres te Pretoria voorgelê en word hier ter inligting aan VMEO-lede herhaal in Engels.

(b) case studies.

Concerning the first term of reference 14 CIE participating countries provided the relevant information in respect of the total and per capita power consumption, proportion of power consumption for lighting in the total electricity consumption and the consumption of light sources (a) incandescent (b) fluorescent and (c) HID lamps. Unfortunately in respect of the R.S.A. this information could not be extracted despite repeated efforts by the SANCI correspondent. Regarding case studies very little was achieved within the past quadrennium. It was however resolved that this Committee be redesignated TC 4.9 — Lighting Economics — for the next quadrennium which is a more appropriate description of the scope of this Committee which should enable the Committee to submit a final report within its terms of reference by 1983.

## 1.2 Report on discussions at Kyoto

The Chairman reported that a computer programme had been set up to evaluate the information received from the participating countries so that realistic forecasts could be made concerning the future application of existing and new developments in light sources within the economic framework of energy consumption, energy costs and increased productivity.

The information supplied concerning the proportion of electric energy consumed by lighting indicates so far that in Europe this amounts to between 8% to 12%. As far as America is concerned, there appears to be a large variation between different consumer groups and no definite information could be supplied as these figures were still being evaluated and studied by them.

It was the consensus of the meeting however, that much more detailed statistical information is required from member countries before an accurate evaluation could be made and the computer programme realistically implemented.

## "1.3 Future Programme

It was resolved that those member countries who could assist should provide information on definite case studies concerning the improvement to and/or alterations to existing lighting installations with specific reference to the economic benefits and influence upon productivity.

Finally it was resolved that as lighting economics was becoming a very relevant factor with the practical application of approved design guides and criteria that an all-out effort is required by all member countries in providing the relevant statistical information so that a final report and recommendations can be submitted within the next quadrennium."

### "Technical Committee TC 4.6: Road Lighting:

The Chairman reported that considerable work had been done by this Technical Committee which had had one Recommendation (12/2) and six Technical Reports published by the CIE during this last quadrennium.

Subcommittee 1, Fundamentals of Lighting Performance, is a long term project which will investigate the concepts of supply and demand, visual performance and visibility levels with the aim of providing a visibility basis for the next revision of CIE 12. It is hoped that this will also provide answers to the questions of when to light or not to light and what standards should be adopted. All this work is based on accident data.

Subcommittee 2, Road Lighting and Accidents, was still investigating numerous reports which continue to be received. It was decided that the old 1960 CIE report would be revised and published in three sections.

1. A statement, aimed at the highest levels of management and policy makers of approximately 1 page in length setting out the overall position.
2. A more detailed statement aimed at advisors to the administrators giving more data with cost-benefit relationships.
3. Full details of all studies which would be of greater interest to application engineers and students. This subcommittee anticipates that its work will be completed in 1980.

Mr. Marsden presented a paper entitled "Road Lighting and Accidents" compiled by himself and Messrs. Hargraves, Cobb and Scott (UK). This paper was based on the extensive research which has been conducted in the UK for the Transport and Road Research Laboratories in England. Although the numerous data collected have not yet been fully analysed, there is much information which is of great interest. In summary the quantity of light provided appears to have the greatest effect on accident reduction, overall uniformity has some effect but its significance is as yet "not proven", whereas glare appears to be the least important component.

Subcommittee 3, Lighting of Tunnels, has now completed its investigations into the lighting of threshold zones and Draft 7, which is only an edited version of the previous draft, will be voted on by members before the end of October and, as this is expected to be accepted, will be sent to the Action Committee for final approval as soon as possible thereafter. Two papers on this subject were presented "Adaptation Luminance of Drivers' Eyes Approaching a Tunnel Entrance in Daytime" by Darisada, Yoshikawa and Yoshimura (Japan) and "Visibility Requirements for Highway Tunnels" by Gallagher and Freedman (USA). The latter was based on a research programme which included the reactions of 10 000 motorists to different lighting levels at the entrance to one tunnel in the United States. Although the data obtained was extremely interesting, it was felt that as these were related to one tunnel only, and therefore only one background, this investigation did not fundamentally change the conclusions of Narisada.

Subcommittee 4, Fundamentals of Road Surfaces, is preparing a report about lighting and road surfaces which will include, with the reflection properties, such aspects as surface texture, composition, markings, skid resistance and noise reduction. This work is being done with the full collaboration of PIARC and joint meetings have been held. The final report, expected in 1981, will be of interest to all engineers concerned with road construction. Two papers were presented, "The Relationship between Reflection Properties, Composition and Textures of Road Surfaces" by Burghout and Kema (Netherlands) and "Effects of Wear and Composition on Road Surface Reflection Properties" by Nielsen, Sorenson (Denmark) Forsberg and Persson (Sweden).

The draft report by Subcommittee 5, Road Lighting for Wet Conditions has now been accepted and will be published as a Technical Report by the Action Committee in due course. Research in Scandinavia has shown that over the past two years, accidents had increased 45% under wet road conditions, whereas the increase on dry roads was only 15%. There was still a need for all countries to study the effects of road lighting under wet conditions and to feed back data to CIE. An important aspect is the visibility of road markings under these conditions.

"Subcommittee 6, Installation Design and Economics, has shown that it is not possible to compare global costs and lighting qualities, as costs of equipment, labour and electricity varied considerably. The need for "recipe" systems was discussed, as well as the advantages and disadvantages of the forms adopted in CIE publication 34, which gives different tables for individual lanterns, and the BSS system which gives tables for groups of lanterns. The eight class classifications originally proposed by Marsden and Simons have subsequently been found to be unsatisfactory and a new six class classification based only on control and throw, appears to offer better scope. It was felt that the work of compiling "recipe" systems, should be left to each country to draw up their own for their own use, but that these should all be based on the standards set by CIE.

Subcommittee 7, deals with terminology and is working with TC 1.1 on an overall revision of the CIE vocabulary. Subcommittee 8, Lighting and Astronomy, was formed during the last quadrennium as a result of an approach by the International Astronomical Union. A report has been drawn up on the effects of road lighting on sky visibility and gives practical advice to lighting engineers on co-operation with astronomers and on lighting design in the vicinity of observation areas.

With regard to the current and future working programme of TC 4.6, the aim is for long term investigations of the demand side of road lighting for a sounder more logical basis for lighting recommendations in the future and further detailing of the supply side. A new subcommittee was formed under the chairmanship of Yates (South Africa) to investigate and report on the justification for street lighting other than road accidents and will cover aspects such as the road environment, residential and pedestrian orientated areas, city centres, lighting and crime and aesthetics."

A. H. L. FORTMANN

SANCI REPRESENTATIVE/SANKY VERTEENWOORDIGER



The photographs show:—

1. electrical equipment kiosk complete as installed.
2. kiosk with cover removed showing meters and M.C.B.'s.
3. bus bar assembly mounted on back of equipment board.

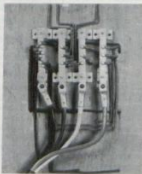
These illustrations cover the use of an electrical equipment kiosk when housing 9 single phase domestic KWH meters with miniature circuit breakers. Any other type of electrical or non-electrical equipment can be housed in a similar manner.

The range of standard electrical equipment kiosks is available with 1 door, as shown in illustrations, having an overall depth of 340mm or alternatively with 2 doors (one on each side) having an overall depth of 430mm.

The equipment board which is 19mm treated block-board is fitted to a galvanised steel frame mounted on a root. Alternatively, if installed on a concrete floor, the steel frame can be bolted to the floor. Equipment can be fitted to either side of the equipment board. In the illustration shown, the live equipment is fitted on the back of the board and is not accessible unless the cover is removed. The cover is fixed by bolting to the frame.

The meters are read by opening the door only and the meter reader is thus protected from the live equipment.

The galvanised steel frames include a range of holes in the base to act as a gland plate and to accept various sizes of cable glands as shown overleaf.



The covers are manufactured in heavy duty glassfibre reinforced plastic to S.A.B.S. 141. They are thus resistant to corrosion. The colour is light grey to S.A.B.S. 1091/F.48.

The root is also in glassfibre reinforced plastic but the design can be used with a concrete root if this is desired.

All of our electrical equipment kiosks include danger signs in three languages and are black on yellow to S.A.B.S. 872.

We also manufacture a wide range of other products including Yachts, Modular Buildings, Trolleys, Agricultural Spray Tanks, Litterbins etc.



**GOLNIX**  
ENGINEERS IN PLASTICS



CAPE  
(021) 95-2165  
P.O. BOX 2512  
CAPE TOWN 8000  
TELEX 57-24112 S.A.

TRANSVAAL (011) 836-4593 (011) 834-4169 P.O. BOX 260092 EXCOM 2023	NATAL (031) 78-3718 P.O. BOX 13 SARNIA 3615
--	---



**REPORT:  
INTERNATIONAL MEETING  
OF T.C. 64:  
ELECTRICAL INSTALLATIONS  
OF BUILDINGS —  
Pretoria: 13-17 October 1980**

The meeting was attended by 58 delegates from 18 member countries under the Chairmanship of Mr. A. A. Middlecote of the SABS. The South African delegation consisted of Mr. H. Goldie of the Department of Public Works, Mr. V. A. H. McDonald of the Electrical Contractor's Association, Messrs. B. H. Lawrence and J. V. Grant of the SABS and Messrs. J. D. Dawson and J. A. Loubser of the AMEU. A very long agenda was prepared and only a brief summary is set out hereunder.

1. A report to note the results of the voting which took place according to the 6 months' rule of the following preliminary reports:—
  - a. Isolation and switching.
  - b. Devices for isolation and switching.
  - c. Safety supply systems.
  - d. Protection against thermal effects.
2. Reports of Working Groups:—
  - WG 1: Definitions.
  - WG 2: Current carrying capacity of conductors and related overcurrent protection.
  - WG 3: External influences.
  - WG 4: Effects of current passing through a body.
  - WG 7: Supply to caravans, boats and yachts.
  - WG 8: Earthing problems concerning data processing equipment and related matters.
  - WG 9: Disconnecting times and related matters.
  - WG 11: Demand on diversity.
  - WG 12: Initial inspection and testing.
  - WG 13: Isolating and switching.
  - WG 14: Safety services and standby supplies.
  - WG 16: Construction site installations.
  - WG 18: D.C. Components.
3. Discussion on preliminary documents for inclusion in the rules
  - a. Sealing of passages for electrical wiring.
  - b. Current carrying capacities.
  - c. Switchgear and controlgear.
  - d. Identification of the PEN conductor.
  - e. Use of overcurrent protective devices in TT systems.
  - f. Protection against fire.
  - g. Classification of industrial equipment with regard to protection against electric shock.
  - h. Proposals for amendments to IEC publication 364-4-41.
  - i. Problems of requirements for HV installation.
  - j. Requirements for electrical installations near kitchen sinks and laundry tubs.
  - k. Classification of switchgear and accessories from the view point of protection against electric shock.

The South African delegation had only limited success with their proposals, presumably because of the fact that our leader Roger Everatt took ill the week before the commencement of the meeting. Fortunately, I can report that his condition is now much better.

All the activities for the week, meetings as well as socials, were arranged by the SABS under the competent guidance of Mr. Middlecote and I am convinced that our overseas visitors were favourably impressed with our country. Therefore we want to sincerely thank the SABS and Mr. Middlecote for the competent arrangements.

It was Mr. Middlecote's last meeting as Chairman of TC 64 after a period of 10 years. He has already received Honorary Membership of our association, so all that remains to be said is — "thank you very much".

**VERSLAG:  
INTERNASIONALE VERGADERINGS  
VAN T.K. 64:  
ELEKTRIESE INSTALLASIES  
VAN GEBOUE —  
Pretoria: 13-17 Oktober 1980**

Die vergadering is bygewoon deur 58 afgevaardigdes van 18 lidlande onder die oorsitterskap van mnr. A. A. Middlecote van die SABS. Die Suid-Afrikaanse afvaardiging het bestaan uit mnr. H. Goldie van die Departement van Openbare Werke, mnr. V. A. H. McDonald van die Elektriese ontraakteursvereniging, mnr. B. H. Lawrence en mnr. J. V. Grant van die SABS en mnr. J. D. Dawson en J. A. Loubser van die VMEQ. 'n Baie lang agenda is voorberei en slegs 'n kort opsomming word hier weergegee.

1. Verslag oor die resultate van die stemming gehou volgens die 6 maande reël van die volgende voorlopige dokumente:—
    - a. Isolering en skakeling.
    - b. Apparaat vir isolering en skakeling.
    - c. Veilige spanningsvoersisteme.
    - d. Beskerming teen termiese effekte.
  2. erslag van Werksgroepe is:—
    - WG 1: Definisiës.
    - WG 2: Stroomdravermoeë van geleiers en geassosieerde oorstrom beveiliging.
    - WG 3: Eksterne invloede.
    - WG 4: Effek van elektriese stroom deur 'n liggaam.
    - WG 7: Toevoer na woonwaaens, bote en jagte.
    - WG 8: Aardingsprobleme i.v.m. dataverwerkingstoerusting.
    - WG 9: Isoleerskakeltye en verwante items.
    - WG 11: Aanvraag en diversiteit.
    - WG 12: Aanvanklike inspekie en toets.
    - WG 13: Isolering en skakeling.
    - WG 14: Bystandstoevoere.
    - WG 16: Konstruksiepersele.
    - WG 18: Gelykstroombestandpente.
  3. Bespreking van voorlopige dokumente vir insluiting in die reëls
    - a. Afsleë van kanale vir elektriese bedrading.
    - b. Stroomdravermoeëns.
    - c. Skakeltyg in beheertoerusting.
    - d. Identifikasie van die PEN-geleiers.
    - e. Gebruik van oorstrombeveiligingstoerusting in TT-sisteme.
    - f. Beskerming teen brand.
    - g. Klassifisering van nywerheidstoerusting m.b.t. beskerming teen elektriese skok.
    - h. Voorsteltel tot wysigings van IEK publikasie 364-4-41.
    - i. Probleme met hoogspanningsinstallasies.
    - j. Vereistes vir elektriese installasies in die nabyheid van opwasbakke.
    - k. Klassifisering van skakeltyg en bybehore m.b.t. beveiliging teen elektriese skok.
- Die Suid-Afrikaanse afvaardiging het maar beperkte sukses gehad met hulle voorstelle, wat moontlik te wyte is aan die feit dat ons leier Roger Everatt die naweek voor die aanvang van die vergadering vry ernstig siek geword het. Gelukkig kan ek rapporteer dat dit nou heelwat beter met hom gaan. Al die aktiwiteite vir die week, vergaderings sowel as sosial is deur die SABS gereël onder die bekwaame leiding van mnr. Middlecote en ek is seker dat ons oorsese besoekers 'n baie gunstige indruk van ons land gekry het. Langa hierdie weg wil ons dan vir die SABS en mnr. Middlecote baie dankie sê vir die bekwaame reëlings. Dié was mnr. Middlecote se laaste vergadering as Voorzitter van TK 64 na 'n tydperk van 10 jaar. Hy het alreeds ere-lidmaatskap van ons vereniging ontvang, dus al wat ons nou kan sê is — "baie dankie".

J. A. LOUBSER  
REPRESENTATIVE/VERTEENWOORDIGER

**REPORT: 44th MEETING OF THE  
INTERNATIONAL ELECTROTECHNI-  
CAL COMMISSION  
Sydney, Australia, 21 May-2 June 1979**

36 Member countries were represented by 660 delegates who are concerned with international standardising in the field of electrotechnical, electronics and communications engineering. Homage is paid to our Australian hosts and in particular to Messrs. R. D. Waldie, F. M. Mathews, W. I. Stewart and K. Parsons for the competent arrangements which made the meeting such a great success.  
My personal thanks also to Messrs. A. A. Middlecote and J. V. Grant of the SABS for the arrangements which they made in this connection.

**TECHNICAL COMMITTEE NO. 64:  
ELECTRICAL INSTALLATIONS OF BUILDINGS**

The South African delegation consisted of four members viz. Messrs. R. Everatt, J. A. Louber, H. Goldie and R. Pinto, the first two being permanent members of the South African National Committee. Mr. W. Barnard also attended a few of the TC 64 meetings.

A very long agenda had been prepared for the meeting and a brief summary is here set out.

1. Report on the voting on the acceptability of draft documents:—
  - a. Estimation of Maximum Demand.
  - b. Tabulation of common rules.
  - c. Earthing and protective conductors.
  - d. D.C. touch voltage.
  - e. Voltage bands.
2. Reports by working groups
3. Discussions on draft documents for incorporation into the rules:—
  - a. Definitions.
  - b. Protection, general.
  - c. Protection against electric shock.
  - d. Protection against fire.
  - e. Risk of burns.
  - f. Wiring systems. \*
  - g. Fire barriers. \*
  - h. Switchgear and control gear. \*
  - i. Isolation and switching.
  - j. Functional switching.
  - k. Safety and standby supplies.
  - l. Identification of conductors.
  - m. Requirements for special locations.
4. Programme of future work

Due to lack of time the items marked \* were not discussed.

All the secretarial documents referred to under 1 had received a favourable vote and will be published by IAT in due course as additional parts of document 364.

The reports dealt with under 2 were generally devoid of contentious matter, merely indicating the way in which the groups were working and the extent of progress.

The draft documents noted under 3a and 3b were acceptable and will be circulated to all member countries for voting. The draft document dealt with under 3c was a very poor effort indeed and it was found that U.K. were closely aligned with S.A. in calling for extensive deletion of irrelevant requirements and extensive simplification and re-arrangement of the relevant clauses. Most of the U.K. and S.A. comments were accepted by the Committee for incorporation in a re-written document; in particular, an S.A. amendment rationalising the protection required on overhead lines was accepted.

The documents referred to in 3d and 3e were technically innocuous but the committee agreed, under pressure from U.K. and S.A., to transfer elsewhere large sections of text which properly belonged to installation requirements rather than to means of protection.

**VERSLAG: 44ste ALGEMENE  
VERGADERING VAN DIE ELEKTRO-  
TEGNIËSE KOMMISSIE  
Sydney, Australië, 21 Mei-2 Junie 1979**

Die 36 lidlande was verteenwoordig deur 660 afgevaardigdes wat aan die internasionale standaardisering op die gebied van elektrotegniese, elektroniese en kommunikasie ingenieurswese werk.

Hulde word gebring aan ons Australiese gasheer en veral mnr. R. D. Waldie, F. M. Mathews, W. I. Stewart en K. Parsons, vir die bekwame reëlings wat die vergadering so 'n groot sukses gemaak het.

My persoonlike dank ook aan mnr. A. A. Middlecote en J. V. Grant van die SABS vir die reëlings deur hulle getref in dié verband.

**TEGNIËSE KOMITEE NR. 64:  
ELEKTRIESE INSTALLASIES VAN GEBOUE**

Die Suid-Afrikaanse afdeling bestaan uit vier lede nl. R. Everatt, J. A. Louber, H. Goldie en R. Pinto. Eersgenoemde twee is vaste lede van die Suid-Afrikaanse Nasionale omtree. Mnr. W. Barnard het ook enkele van TK 64 se vergaderings bygewoon.

'n Baie lang agenda is voorberei vir die vergadering en 'n kort opsomming word hier weergegee.

1. Verslag oor die resultate van die stemming gehou oor die aanvaarbaarheid van die volgende voorlopige dokumente:—
  - a. Beraming van Maksimum Aanvraag.
  - b. Tabulering van algemene reëls.
  - c. Aarding en beskermingsgeleiers.
  - d. Gelykstromaanraakspanning.
  - e. Spanningsbande.
2. Verslag van werksgroepe
3. Bespreking van voorlopige dokumente vir insluiting in die reëls:—
  - a. Definisies.
  - b. Beskerming, algemeen.
  - c. Beskerming teen elektriese skok.
  - d. Beveiliging teen brand.
  - e. Risiko van brand.
  - f. Bedradingsisteme.
  - g. Brandskerms.
  - h. Skakeltoeg en beheertoerusting.
  - i. Isolering en skakeling.
  - j. Funktionele skakeling.
  - k. Veiligheid en bystandstoevoere.
  - l. Identifisering van geleiers.
  - m. Vereistes vir buitengewone omgewings.
4. Program van toekomstige werk

As gevolg van 'n gebrek aan tyd is items f, g en h nie bespreek nie.

Al die sekretariële dokumente waarna in 1 verwys is, is goedgekeur, en sal dus binnekort gepubliseer word as bykomende dele tot dokument 364.

Die verslae onder 2 genoem het nie veel bespreking uitgelok nie omdat dit meer die rigting waarin die werksgroepe werk asook die vordering tot dusver aangedul het.

Voorlopige dokumente 3a en 3b is aanvaar en sal onder lede gesirkuleer word vir stemming. Die voorlopige dokument wat onder 3c behandel is, was 'n baie swak poging deur die werkgroep en die Verenigde Koninkryk het S.A. ondersteun i.v.m. die weglating van sekere nie-toepaslike asook vereenvoudiging en herarrangering van toepaslike klousules. Meeste van die V.K. en S.A. se kommentare is aanvaar deur die komitee en sal ingesluit word in die herakrewe dokument. In besonder is 'n S.A. wysigingsvoorstel oor die rasionalisering van beskerming op bognedre lyne aanvaar.

Die dokumente waarna in 3d en 3e verwys word is tegnies onskadelik maar onder druk van die V.K. en S.A. het die komitee ingestem om groot gedeeltes wat in werklikheid installasie vereistes is na ander dokumente oort te plaas.

A number of modifications were accepted by the Committee but few of these made any significant alteration to the content of the document which will, after modification and editing, be circulated to all countries for voting under the "Six Months Rule". The same result followed the discussions on "Functional Switching" (3j).

The document dealing with "Safety and Standby Supplies" was a good one and, with minor modifications accepted by the Committee, will be circulated to all countries for voting under the "Six Months Rule". The principal modification is that the document will deal only with Safety Supplies.

On the last day of the meeting it was resolved that the most important item on the agenda "Requirements for Special Locations" (3m) should be brought under discussion and other less important matters deferred.

A brief explanation is needed at this point. For some years a Working Group (WG 3) had been engaged in codifying the external influences which had a bearing upon the design of an installation and, more recently, in stipulating what measures of protection and what installation techniques must be applied in relation to the external influences. The external influences are listed on page 6 of the SABS Code of Practice for the Wiring of Premises and the WG 3 codification gives an alphanumerical statement of the degree to which any influence may be present.

The intention has been that the same measures of protection and the same installation techniques would be applicable whenever the same combination of external influences occurred.

The Committee's decision was that WG 3 be directed to —

- preparing separate prescriptions for specific locations, these locations to be stipulated by National Committees.
- continuing simultaneously with their work on the application of the codification.
- using the South African tabulation as a basis for the latter work.

and the Committee further agreed that the system based on codification would eventually supersede the individual prescriptions.

Thus the meeting ended, as far as S.A. is concerned, with a partial success in the midst of failure; in the overall scene, however, the S.A. contribution to the proceedings was a major and valuable one. It was heartening to find committee decisions changed by virtue of S.A.'s special knowledge in regard, for example, to the prevalence of lightning or the occurrence of poor earthing, conditions; it was interesting, too, to find the USSR delegation once again seeking S.A.'s assistance in putting their points across. As a final touch it was gratifying that the Committee unanimously agreed, subject to the approval of the Central Committee of the IEC, to hold its next meeting in S.A. in October 1981.

Mr. Middlecote has now for many years been the Chairman of TC 64 and the meeting which is to be held in S.A. in October 1981 will probably be the last under his Chairmanship. If there is a person who fully deserves the title "Ambassador for S.A." that person will be Mr. Middlecote, therefore we want to thank him for a task well fulfilled.

## COUNCIL OF THE IEC

It was also my privilege to attend the meeting of the IEC under the Chairmanship of Prof. N. Tagaki (Japan).

Matters that were discussed were inter-alia:—

1. Liaison between the IEC and the International Standards Organisation.
2. A report in connection with the preparation of ISO/IEC guidelines over self-certifying.
3. Guidelines to the determination of the technical competency of test laboratories.
4. The determination of the necessity or not of an international third party certifying scheme.
5. Guidelines in connection with the implementation of international standards.
6. Future General Meetings.

In this regard it can be reported that these meetings will be held as follows:—

- 1980 June in Stockholm, Sweden.
- 1981 May in Geneva, Switzerland.
- 1982 June in Rio de Janeiro.

'n Aantal wysigings is aanvaar t.o.v. 3i, maar weinig van hulle het in werklikheid enige effektiewe verandering aan die wese van die dokument teweeggebring. Hierdie dokument sal nou volgens die "Ses-maande-reël" onder al die ledelende gesirkuleer word vir stemming. Dieselfde geld ook vir die dokument oor "Funksionele Skakeling" (3j).

Die dokument wat handel oor "Veiligheids- en Bystandstoelvoere" (3k), is ook met klein wysigings aanvaar en sal ook nou vir stemming volgens die "Ses-maande-reël" gesirkuleer word. Die enigste belangrike wysiging in dié verband is dat die dokument nou slegs oor eilighedstoelvoere sal gaan.

Op die laaste dag van die vergadering is daar besluit dat die belangrikste item op die agenda n.l. "Verreites vir buitengewone omgewings" voorkeur moet geniet bo sekere van die minder belangrike items.

Ter verduideliking kan genoem word dat vir 'n hele aantal jare reeds 'n werkgroep (WG 3) besig is met die kodifisering van eksterne invloede op die ontwerp van 'n installasie; en meer onlangs in die stipulering van mate van beskerming en installasie tegnieke s.g.v. sodanige eksterne invloede. Die omgewingstoestand wat 'n invloed het op die bedrading word genoem op bladsy 6 van die Gebruiksaanbeveling vir die Bedrading van Persele van die SABS en WG 3 stel 'n alfanumeriese kodifisering voor waarvolgens die graad van invloed bepaal kan word.

Die doel hiervan was dat dieselfde mate van beskerming en installasie tegnieke altyd van toepassing moes wees waar dieselfde kombinasie van eksterne invloede teenwoordig was. Die beslissing van die komitee was dat WG 3 opdrag gegee word om —

- Aparte beskrywings vir spesifieke omgewing voor te berei en dat die verskillende nasionale komitees die omgewingstoestand wat kan ontstaan uiteensit.
- oort te gaan gesamentlik hiermee met hulle werk oor aanwending van die kodifiseringsreël.
- Die S.A. tabelleringsmetode te gebruik as 'n basis vir die stelsel.

Verder het die komitee ook besluit dat wanneer die kodifisering voltooi is daar weggedoen sal word met die individuele beskrywings.

Wat S.A. betref het die vergadering dus vir ons gedeeltelik sukses beteken. As geheel gesien was die Suid-Afrikaanse bydrae groot en waardevol. Dit was 'n riem onder die hart om te sien hoe sekere beslissings verander is vanuit S.A. 'n besondere kennis oor onderwerpe soos bv. die weerlig en swak beaardigingstoestand. Verder was dit ook interessant hoe dikwels 'n afdruiging soos die van Rusland die Suid-Afrikaanse standpunt ondersteun het en ook staat gemaak het op die Suid-Afrikaanse afdruiging se ondersteuning om hulle punt te stel. As finale punt was dit baie aangenaam om te sien hoe al die lede van die komitee eenparig ingestem het om die volgende vergadering van TK 64 gedurende Oktober 1981 in S.A. te hou.

Mnr. A. Middlecote het nou vir baie jare as Voorsitter van TK 64 opgetree in die vergadering wat gedurende Oktober 1981 in S.A. gehou sal word, sal moontlik die laaste wees onder sy Voorsitterskap. As daar nou iemand is wat die titel "Ambassadeur van S.A." ten volle verdien dan is dit mnr. Middlecote. Langs hierdie weg wil ons nou vir hom baie dankie sê vir 'n taak welgedaan.

## RAAD VAN DIE IEK

Dit was verder my voorreg om die vergadering van die Raad van die IEK met Prof. N. Tagaki (Japan) as Voorsitter by te woon.

Sake wat o.a. bespreek is, was:—

1. Skakeling tussen die IEK en die Internasionale Standaard-Organisasie.
  2. 'n Verslag oor die voorbereiding van ISO/IEK-ryglie oor self-sertifisering.
  3. Ryglie vir die bepaling van die tegniese bevoegdheid van toetslaboratoriums.
  4. Die bepaling van die nodigheid al dan nie vir 'n internasionale derde party sertifiseringskema.
  5. Ryglie oor die implementering van internasionale standaarde.
  6. Toekomstige Algemene Vergaderings.
- In die verband kan gerapporteer word dat die vergaderings as volg gehou sal word:—
- 1980 Junie te Stockholm, Swede.
  - 1981 Mei te Geneva, Switserland.
  - 1982 Junie te Rio de Janeiro.

The President once again drew the attention of all to the fact that during the meeting of the Council which was held in Moscow it was resolved that representatives of host countries must concur beforehand that all the members of the IEC will be welcome in their respective countries. Countries addressing invitations to the IEC must realise that they invite the organisation as a whole. All of the three host countries mentioned above have agreed that all members will be welcome.

#### GENERAL:

The decision taken by the AMEU to send a delegate to the General Meeting of the IEC was undoubtedly the correct one. The S.A. National Committee very often comments on preliminary documents and just as often our comments are, without any reason, rejected by the working group with the words "not accepted". The final decision still rests with the Main Committee of TC 64 and if we can be present the scale can still be turned in our favour as in fact happened quite often during the preceding meeting. I believe that I can state quite categorically that S.A. is one of the main contributors to TC 64 together with countries such as USA, England, France and West Germany.

#### CONCLUSION:

My personal contributions to the conference proceedings were small. I however learned a lot through discussions with representatives of the various countries and I hope to utilise that knowledge in our country. With this, I want to express my thanks for the exceptional experience gained, first of all to the AMEU and secondly to our President, Mr. Botes, who also willingly stepped down so as to enable me to attend the conference.

J. A. LOUBSER

MEMBER OF TC 64/LID VAN TK 64

Die President het weer eens almal se aandag daarop gevestig dat daar tydens die vergadering van die Raad wat in Moskou gehou is, besluit is dat verteenwoordigers van gasheerlande vooraf moet instem dat alle lede van die IEK welkom sal wees. Lande wat 'n uitnodiging aan die IEK rig, moet beseef dat hulle die Organisasie in sy geheel uitnooi. Aldrie die gasheerlande het toe ingestem dat almal welkom sal wees.

#### ALGEMEEN:

Die besluit van die VME0 om die verteenwoordiger op TK 64 na die Algemene Vergadering van die IEK te stuur, was ongetwyfeld die regte een. Die S.A. Nasionale Komitee lewer dikwels kommentaar op die voorlopige dokumente en netso dikwels word ons kommentaar sonder enige rede geïgnoreer deur die werkgroep met die woorde "not accepted". Die finale beslissing lê egter by die hoofkomitee van TK 64 en as ons teenwoordig kan wees kan ons nog die skaal in ons guns swaai soos wat dikwels gebeur het gedurende die afdelings vergadering. Ek glo dat ek sonder twyfel kan sê dat S.A. een van die groot bydraers is tot TK 64 saam met lande soos die VSA, Engeland, Frankryk en Wes-Duitsland.

#### SLOT:

My persoonlike bydrae tot die konferensieverrigtinge was gering. Ek het egter baie geleer, nie net met die oog nie, maar ook deur samesprekings met afgevaardigdes van ander lande en ek hoop om daardie kennis in ons land te gebruik. Hiermee wil ek my dank uitspreek vir die besonderse onderverinding eerstens teenoor die VME0 en tweedens teenoor ons President, mnr. Botes, wat gewilliglik teruggestaan het sodat ek die vergadering kon bywoon.

# 3F FIBREGLASS STREET-LIGHTING POLES

STRAIGHT AND CANTILEVER TYPES

Manufactured by:

**FRITSCH FOELLMER ENG. (PTY) LTD.**

● THE OLDEST-ESTABLISHED GRP POLE  
MANUFACTURING COMPANY IN THE R.S.A.

P.O. Box 4081, DURBAN 4000

Tel. (031) 839640

# REPORT: 45th GENERAL MEETING OF THE ELECTROTECHNICAL COMMISSION Stockholm 1980

BY MR. P. J. BOTES, PRESIDENT

The 45th General Meeting of the International Electrotechnical Commission was held in Stockholm, Sweden from 2 to 13 June 1980 and I was privileged to be able to attend this meeting as President of the AMEU. The meeting was attended by more than a 1 000 delegates from 39 countries.

Such was the agenda of the General Meeting that there were very few discussion points in which I could participate except Technical Committee 23 'Electrical Accessories' under which Technical Subcommittee 23C 'Worldwide Plug and Socket Outlets' is incorporated. South Africa holds the secretariat of Technical Subcommittee 23C. I also had the opportunity to attend the session of Technical Committee 59 'Performance of Household Electrical Appliances' and Technical Committee 34D 'Luminaires' and the meetings of the Council and the Committee of Action.

In my report on the International Electrotechnical Committee Congress held in Nice, France I mentioned that the highlight of the congress was the acceptance by the delegates of Technical Committee 23C of a square pin 16 A plug and socket outlet in 25 mm and 50 mm modules. Since then the National Committees of the different countries have decided otherwise and after years of consideration it was decided in Stockholm to revert to the round pin type and working groups were appointed to formulate proposals and incorporate certain recommendations. The new Chairman of Subcommittee 23C is Mr. B. I. Folcher of Sweden.

At the meeting of the Main Committee, i.e. SC23, South Africa invited the Technical Committee as well as Subcommittee 23C to meet in the Republic in the Spring of 1981.

I also attended a Committee of Action meeting when the R.S.A. was still a member of that Committee. The Committee was chaired by the Acting President, Dr. V. I. Popkov of Russia, in the absence of the President Dr. N. Takagi of Japan. Various liaison matters on standards and investigations between IEC, IAEA (International Atomic Energy Agency) and ISO (International Standards Organisation) were discussed. Prof. Linnquist, representing the International Conference on Lightning Protection, addressed the meeting and called for a system of co-operation between the two bodies, viz. IEC and ICLP. As a result the IEC decided to commence work in the field of lightning protection and 'to prepare guides, or, where possible, international standards for lightning protection for structures and buildings as well as for persons, installations and contents in or on them', in co-operation with other international committees in this field.

Of importance was the discussion on microprocessor assemblies and the need for international work to ensure that the interface conditions between microprocessor assemblies and the equipment with which they were used were satisfactory. The Committee also dealt with a Swedish Committee's proposal that consideration be given to the standardization of cable lugs and methods for connection by means of crimping.

The Committee also decided to undertake work on direct photo-voltaic conversion of solar energy into electrical energy. As mentioned, I was privileged to attend the Council Meeting as a member of the South African National Committee. The next General Meeting will be held in Montreux, Switzerland and in 1982 in Rio de Janeiro. Mr. W. A. McAdams of the U.S. was elected as President.

# VERSLAG: 45ste ALGEMENE VER- GADERING VAN DIE ELEKTRO- TEGNIËSE KOMMISSIE Stockholm 1980

DEUR MNR. P. J. BOTES, PRESIDENT

Die 45ste Algemene Vergadering van die Internasionale Elektrotegniese Kommissie het vanaf 2 tot 13 Junie 1980 in Stockholm, Swede plaasgevind. Dit was my voorreg om hierdie vergadering as President van die VMEO te kon bywoon. Die vergadering is bygewoon deur meer as 1 000 afgevaardigdes van 39 lande.

Die sakelys van die Algemene Vergadering was sulks dat daar weinig besprekingspunte was waarby ek kon aansluit, behalwe Tegniese Komitee 23 'Electrical Accessories', waaronder Tegniese Subkomitee 23C 'Worldwide Plug and Socket Outlets' ingesluit is. Suid-Afrika hou die sekretariaat van Tegniese Subkomitee 23C. Ek het ook die geleentheid gehad om die sitting van Tegniese Komitee 59 'Performance of Household Electrical Appliances' en Tegniese Komitee 34D 'Luminaires' by te woon.

Dit was dan ook vir my 'n voorreg om die vergaderings van die Raad en die Komitee van Aksie te kon bywoon.

In my verslag oor die bywooning van die Internasionale Elektrotegniese Komitee Kongres wat in Nice, Frankryk gehou was, het ek gemeld dat die hoogtepunt van die kongres was die aanvaarding deur die afgevaardigdes van Tegniese Komitee 23C van 'n vierkantige pin 16 A prop en sokkeltag in 25 mm en 50 mm modules as die enigste standaard. Sedertdien het die Nasionale Komitees van die verskillende lande anders besluit en in Stockholm is na jarelange oorweging weer besluit om terug te keer na die ronde pentite en is werksgroepe aangestel om voorstelle in dié verband te formuleer, wat sekere aanbevelings inkorporeer. Die nuwe voorsitter van hierdie Subkomitee 23C is mnr. B. I. Folcher van Swede.

Tydens die vergadering van die Hoofkomitee, nl. SC23 het Suid-Afrika beide die Tegniese Komitee en Subkomitee 23C uitgenooi om in die Lente van 1981 hier te vergader.

Ek het ook die Komitee van Aksie se vergadering bygewoon toe Suid-Afrika nog lid van die Komitee van Aksie was. Die Waarnemende President van die IEC, Dr. V. I. Popkov van Rusland, het optree as Voorsitter in die afwesigheid van die President Dr. N. Takagi van Japan. Verskeie liaison-gevalle met betrekking tot standaarde en ondersoek tussende IEC, IAEA (International Atomic Energy Agency) en die ISO (International Standards Organisation) was bespreek. Professor Linnquist: wat die ICLP (International Conference on Lightning Protection) verteenwoordig, het die vergadering toegesprek en gevra vir 'n sisteem van samewerking tussen die twee liggame, nl. die IEC en die ICLP. As gevolg hiervan het die IEC besluit om te begin werk op die gebied van Weerligbeskerming om 'riglyne daar te stel, of waar moontlik, internasionale standaarde vir weerligbeskerming vir strukture en geboue sowel as persone, installasies en inhoud of daarop', in deelname en samewerking met ander internasionale komitees op dié gebied.

Van belang was die bespreking van mikroprosesseermonterings en die noodsaaklikheid vir internasionale samewerking om te verseker dat die skedingsvlaktoestande tussen mikroprosesseermonterings en die toerusting wat daarmee gepaard gaan, bevredigend is.

Die Komitee het ook die Sweedse komitee se voorstel dat oerweging geskenk word aan die standaardisasie van kabelleere en die metodes van verbinding deur middel van krimpings, bespreek. Die Komitee het ook onderneem om te begin werk aan foto-voltasie omskakeling van sonenergie in elektriese energie.

Soos reeds vermeld, het ek die voorreg gehad om die Randsvergadering as lid van die Suid-Afrikaanse Nasionale Komitee

Four members of the Committee of Action had to be elected in place of the four retiring members, viz. Republic of South Africa, Canada, Germany and Japan. China, Yugoslavia United Kingdom and Italy were elected. Although countries are involved in the elections, it is in fact persons who are involved. South Africa was represented by Albert Alfred Middlecote, Deputy Director General of the S.A. Bureau of Standards and formerly Test Engineer of S.A.R. & H. He has led delegates to the International Electrotechnical Commission's annual general meetings at —

Munich (1956)  
Aix-les-Bains (1964)  
Tokyo (1965)  
Tel Aviv (1966)  
London (1968)  
Teheran (1969)  
Washington (1970)  
Brussels (1971)  
Athens (1972)  
Munich (1973)  
Bucharest (1974)  
The Hague (1975)  
Nice (1976)  
Moscow (1977)  
Florence (1978)  
Stockholm (1980)

At the Washington meeting (1970) he was appointed Chairman of IEC/TC 64: 'Electrical Installations of Buildings' for a period of 7 years. The chairmanship was extended for a further three years in 1977. When South Africa was elected to the Committee of Action of the IEC, Mr. Middlecote served as President of the S.A. National Committee for a period of six years. In 1978 he was appointed in his personal capacity to serve for a further two year period on the Committee of Action in the interest of the S.A. National Committee of the IEC. During this period he was also a member of the Advisory Committee on Safety (ACOS) of the IEC. Mr. Middlecote held various prominent positions such as —

President of the Federation of Societies of Professional Engineers.  
1977/78: President of S.A. Institute of Electrical Engineers.  
1968: President of Council for Automation and Computation.  
1972: Honorary Member of the AMEU.  
1977: President of Associated Scientific & Technical Societies of S.A., 1979/80.

Various representatives of the AMEU who attended the International Electrotechnical Commission meetings can testify to the competent and dignified manner in which Mr. Middlecote conducted himself and the high esteem he commanded.

As mentioned, the Technical Committee SC23 and Subcommittee 23C were invited to have their next meeting here in S.A. The Executive Council of the AMEU decided to entertain the delegates in an appropriate manner.

I would like to express my appreciation for the privilege I had of attending this meeting, and my personal thanks to the SABS and Mr. Middlecote for the arrangements made for me.

te kon bywoon. Die volgende Algemene Vergadering word in Montreux, Switserland en in 1982 in Rio de Janeiro gehou. Mnr. W. A. McAdams van die V.S.A. was verkies tot President.

Vier nuwe lede moes verkies word op die Komitee van Aksie in plek van die uittrede lede, n.l. die Republiek van Suid-Afrika, Kanada, Duitsland en Japan. Sjina, Joegoslavië, Verenigde Koninkryk en Italië was verkies. Alhoewel dit lande is wat in die verkiesings betrokke is, is dit wel persone wat daarby betrokke is.

Albert Alfred Middlecote, Adjunk-Direkteur-generaal van die SABS, voorheen Toetsingenieur van die Suid-Afrikaanse Spoorweë en Hawens, is die persoon wat Suid-Afrika verteenwoordig het. Hy het afgevaardigdes gelei na die Internasionale Elektrotegniese Kommissie se Algemene Vergaderings te —

München (1956)  
Aix-les-Bains (1964)  
Tokio (1965)  
Tel Aviv (1966)  
Londen (1968)  
Teheran (1969)  
Washington (1970)  
Brussels (1971)  
Athene (1972)  
München (1973)  
Boekarest (1974)  
Den Haag (1975)  
Nice (1976)  
Moskou (1977)  
Florence (1978)  
Stockholm (1980)

Tydens die vergadering in Washington (1970) is hy aangestel as Vooritter van IEK/TK 64: 'Elektriese Installasies van Geboue' vir 'n tydperk van 7 jaar. Die voorsitterskap is vir 'n verdere drie jaar verleng in 1977. Toe Suid-Afrika verkies was tot die Komitee van Aksie van die IEK, het mnr. Middlecote daarop gedien as President van die Suid-Afrikaanse Nasionale Komitee vir 'n tydperk van 6 jaar. Gedurende 1978 is hy aangestel in sy persoonlike hoedanigheid om weer vir 'n tydperk van twee jaar op die Komitee van Aksie te dien in die belang van die S.A. Nasionale Komitee van die IEK. Gedurende dié tydperk was hy ook lid van die Veiligheidsadvieskomitee (ACOS) van die IEK. Mnr. Middlecote het verskeie vername poste beklee, onder andere —

Die President van die Federasie van Genootskap van Professionele Ingenieurs.  
1977/78: President van die S.A. Instituut van Elektriese Ingenieurs.  
1968: President van die Raad vir Outomatisasie en Berekening.  
1972: Erelid van die VME0.  
1977: President van die eWetenskaplike Assosiasie en Tegniese Genootskap van S.A., 1979/80.

Verskeie verteenwoordigers van die VME0 wat die Internasionale Elektrotegniese Kommissie bygewoon het, kan getuig van die bekwaamheid en waardigheid waarmee mnr. Middlecote opgetree het en sal ook kan getuig van die baie hoë agting wat hy afgedwing het.

Soos vermeld, is die Tegniese Komitee SC23 sowel as Subkomitee 23C uitgenooi om in die Lente van 1981 hul vergadering in S.A. te hou. Die Uitvoerende Raad van die VME0 het besluit om by hierdie geleentheid die afgevaardigdes op gepaste wyse te onthaal.

Langs hierdie weg wil ek graag my dank betoon vir die voorreg wat ek gehad het om hierdie vergadering te kon bywoon asook my persoonlike dank uitspreek teenoor die SABS en mnr. Middlecote vir alle reëlins wat vir my getref was.

## MNR. A. A. MIDDLECOTE: SABS

Meneer die President, dit gee my 'n groot genoë om die bespreking van die verslag van mnr. Loubser en Botes oor die Algemene Jaarvergaderings van die Internasionale Elektrotegniese Kommissie in te lei.

Sover bekend, is die IEK waarskynlik die oudste internasionale ingenieursorganisasie — meer spesifiek elektrotegniese ingenieursorganisasie in die wêreld.

Op 'n vergadering wat in 1904 in St. Louis, VSA gehou is, is die gedagte die eerste maal geopper dat stappe gedoen moet word om die samewerking van die tegniese verenigings van die wêreld te verky deur die anstelling van 'n verteenwoordigende kommissie om oorweging te skenk aan die standaardisasie van die nomenklatuur en aanslagwaardes van elektriese ultrusting en masjinerie.

So het dit dan gebeur dat die IEK in 1906 gestig is tydens 'n vergadering waarvan mnr. Alexander Siemens, 'n lid van die groot Duitse Siemensfamilie, die voorsitter was.

Die eerste president was die beroemde wetenskaplike Lord Kelvin, en die tweede beroemde Amerikaanse ingenieur Elihu Thomson.

Suid-Afrika is deur mnr. Lee Murray op hierdie stigtingsvergadering verteenwoordig en ons is dus met reg trots daarop dat ons reeds sedert die ontstaan van die IEK met die organisasie geassosieer kon wees.

The first IEC meeting was officially attended by Bernard Price in 1938 after the formation of the SA National Committee with the support of the Government. The National Committee was centred round Kelvin House and it is interesting to note that the AMEU was initially represented by E. T. Price, T. Woolley-Dodd and J. Roberts.

After the Second World War the SABS became responsible for the National Committee and I have been President since I attended my first meeting in 1956 which was held in Munich. The AMEU was first represented in 1971 by that fine "baanbreker" Gabriel Theron, otherwise known as "Gawie". Since then the Annual General Meetings have been attended as follows:

1972 Athens — Jules von Ahlfen and Emil de Villiers

1974 Bucharest, Rumania — Emil de Villiers. Emil came in

late to participate in the official main meeting and sat among the Russian delegates next to the President himself. Thereafter he was known as Emil de Villiersvitch.

1975 Den Haag — Eugene Pretorius with whom it was a great pleasure to discover the interesting parts and people of Den Haag — who loved reading the "High Dutch" newspapers and eating "haring".

1976 Nice — Piet Botes who set the town alight and became intrigued with the "topless".

1977 Moscow — Ken Robsonvitch who successfully evaded the KGB and the tempting baits held out.

1979 Sydney, Australia — officially Mr. Loubser, but unofficially that great bowler and boomerang expert and sporting equipment importer, Wesel Barnard as representing Johannesburg Municipality.

1980 Stockholm — Piet Botes now as President and Bennie van der Walt, the secretary of the AMEU.

This year the IEC celebrates its 75th anniversary and I have arranged for you all to have copies of the official anniversary symbol.

In considering the IEC one must realize that at present it consists of 44 member countries and produces about 150 official documents and standards per year.

Eight thousand documents are accumulated per year covering the work of 81 technical committees and subcommittees which hold over 100 meetings every year.

## MR. P. J. BOTES: ROODEPOORT

Mnr. die President, ek het niks by te voeg tot my verslag nie, behalwe die VME0 te bedank vir die voorreg om hierdie jaarvergadering te kon bywoon, en u aandag te vestig op die belangrike werk wat mnr. Middlecote op internasionale gebied vir Suid-Afrika doen soos in die verslag uiteengesit.

Langs hierdie weg wil ek graag namens die VME0 John Dawson wat eersdaags die IEK in Montreaux, Switserland namens die VME0 bywoon, 'n voorspoedige reis toewens.

## CHIEF INSPECTOR OF FACTORIES — HOOFINSPEKTEUR VAN FABRIEKE

### MR. D. H. FRASER: PRESIDENT

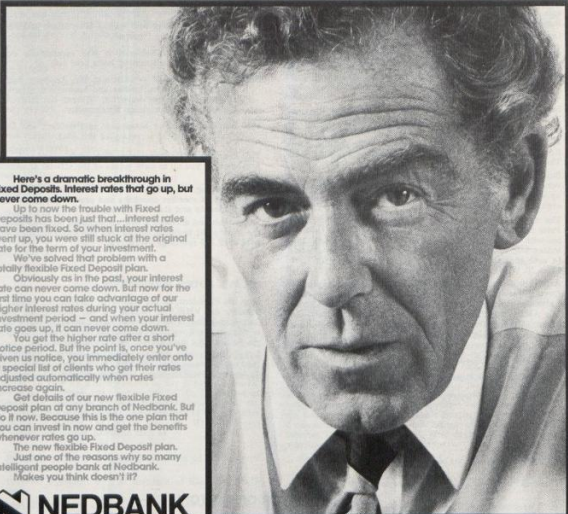
We now proceed to the next item on the agenda, the Address by the Chief Inspector of Factories. Mr. Gus Weich, is well known to all our delegates and therefore needs no introduction. We are grateful to him for his understanding of the problems of Municipal Electrical Engineers and his logical approach to the administration of the Factories Act and the Electrical Wiremen's and Contractors Act. I personally had the pleasure of being a member of a small team under his fatherly care and discipline, overseas, when an investigation was made into Innovative Wiring Systems and I was most impressed by his balanced and philosophical outlook on life under all circumstances. He was still able to smile when he was parted from his luggage for several days in London and when members of his party got a bit out of control at times. I was, therefore, delighted when he agreed to address this Convention. I am sure that what he has to say will be both entertaining and thought provoking. Mr. Weich is leaving for overseas tomorrow, so I count it as a great honour that he

has found it possible to be with us today. He does have to leave at the luncheon break. I now call upon Mr. Weich.

### MR. A. A. WEICH: CHIEF INSPECTOR OF FACTORIES

Mr. President, I want to thank you very much for your kind invitation to me to address this Convention. I hope that this honour does not come my way as a sop but rather as recognition of the very healthy mutual respect for each other which has grown up between the Department and your Association: I may add that my pleasant association with the AMEU is one of the things I treasure very much.

The trouble with creating safety legislation is that lines have to be drawn and limits set. On one side of the line you are law abiding and on the other you are a felon. Of course if you are found to be only slightly guilty the courts in their wisdom may only punish you slightly — at least that is the theory as well as the prayer of the person charged! However, standards must be fixed to show people the way and give them a goal to



**Here's a dramatic breakthrough in Fixed Deposits. Interest rates that go up, but never come down.**

Up to now the trouble with Fixed Deposits has been just that...interest rates have been fixed. So when interest rates went up, you were still stuck at the original rate for the term of your investment.

We've solved that problem with a totally flexible Fixed Deposit plan.

Obviously as in the past, your interest rate can never come down. But now for the first time you can take advantage of our higher interest rates during your actual investment period - and when your interest rate goes up, it can never come down.

You get the higher rate after a short notice period. But the point is, once you've given us notice, you immediately enter onto a special list of clients who get their rates adjusted automatically when rates increase again.

Get details of our new flexible Fixed Deposit plan at any branch of Nedbank. But do it now. Because this is the one plan that you can invest in now and get the benefits whenever rates go up.

The new flexible Fixed Deposit plan. Just one of the reasons why so many intelligent people bank at Nedbank.

Makes you think doesn't it?



**NEDBANK**

Nedbank Limited Registered Commercial Bank

**As a matter of interest:** You can open a Fixed Deposit with as little as R250. Interest can be paid to you monthly, quarterly, half yearly, annually or at the end of your investment period. What's more you can have the interest paid to yourself by cheque, or into an account - or even to a third party. The investment is guaranteed by Nedbank and you get your capital back at the end of your investment period. Should you require money before the end of the period, you can simply pledge your Nedbank Fixed Deposit against a loan. Interest on deposits in excess of R100 000 is negotiable. Ask your branch manager.

GREY-PHILLIPS, BUNTON, MANDEL & BLAKE 6005



aim at. If you do this, those with higher standards may get smug, and hopefully those with lower standards will start worrying.

So where do you set the standards? At what level do you draw the line between rectitude and recidivism? It is not easy, because hard gained experience, advances in technology and research may show you that the line was originally drawn in the wrong place in any case! Does one consult experts and solicit their assistance in setting standards? Yes Mr. President, we do consult experts and even the AMEU. But than one sympathises with the company who advertised for a one-armed accountant and explained their reason that when accountants are asked for an opinion and recommendation they will always say: "On the one hand this but on the other hand, that!"

Sure we regularly consult the experts, but unfortunately we always receive the very best of advice on the pros and cons and in the final analysis we must still make the decision much to the delight of some and to the disapproval of others! What happens when you move the line and set a higher standard? Some of those who were above the standard suddenly discover they are now below it, while those who were below originally discover they are falling further behind, yet neither have changed their practises, only the lines set by the law have been changed and, much to the consternation of everyone, an element of certainty has gone. And how we need to be certain!

I would like to think of the legislators in connection with industrial safety as taking part in the technological progress of our time and not, as some would have it, acting as a counter-productive agency. The exponentially rising demand for basic commodities such as food, synthetics, energy, services etc. calls for a corresponding reply of technological advance and sophistication; safety legislation must not be out of step with this march of progress.

Government regulations must protect life and property against the hazards associated with new technology but at the same time they must create a favourable climate for technological development and optimum use of materials, processes and techniques. This flexible attitude must however not be built into the legislation unless the implications of the developments are also known and understood by the statutory authorities because this very flexibility may lead to hazardous developments.

This interplay between the advance of technology and the necessary restraints by Government could be likened to a man riding a bicycle — he has to go forward in order not to fall off. The legislator must therefore advance at a satisfactory pace but industry must respect the necessity for any restraints that are imposed.

The knowledge required for the technological progress is generated by the research and experience of many people and can no longer be contained in a few standard works or in the expertise of a few people. The transfer of knowledge therefore is necessary in order to stay abreast of the expanding technology. In a relatively small country such as South Africa this transfer of knowledge is possibly of greater importance than in the larger industrial countries because experience does not repeat itself so often here and the experience which does become available from domestic sources should therefore be widely shared in order that all may benefit from it. The statutory control should therefore integrate itself into the national scene so that it may stimulate and be stimulated by common experience, contribute to the common knowledge, look after the safety aspects satisfactorily but not hamper progress!

It is for this reason that I am so grateful for the wonderful co-operation that the Department receives from bodies of experts such as the AMEU and industry in general and that it is always possible to discuss matters of common interest to the benefit of the Department and the industry concerned.

Another aspect of statutory control which should be heeded by all levels of government is what one could call the "attainable level of control". Legislation has often attempted to legislate for the ultimate i.e. ultimate safety through ultimate control, only to find that absolute safety is impossible and absolute control costly. Allow me, in this regard, to quote that eminent Director of the Health and Safety Executive in Britain, John Dunster:

"We will use the best practicable means. We will keep exposures as low as reasonably achievable but we will not, we cannot, provide absolute health and safety. It is often said that the only safe level of radiation is zero — perhaps it is. Certainly the only safe level of work is zero. Indeed, the only safe level of life is zero. If you insist on being dead safe you will have to accept being safely dead."

Here I may add that a safe level for electricity is a "no volt" situation!

I am a firm believer in the 20/80 theory. Many of my colleagues do not agree with me and this convention may also be horrified at the mere thought. What this philosophy adds up to is that one achieves 80 percent results for the first 20 percent effort but that no amount of effort will achieve 100 percent results no matter how great the effort. This does not mean that one must not do one's best, but in trying to reach perfection one may get bogged down in details and never go any further!

This reminds me of the story of the fellow who was given the job of felling a tree. He considered an axe job too untidy and that he would cut the tree down with a saw. After some searching he found a saw but this was blunt. To sharpen the saw he found a file which had seen better days and would not do the job. Mr. President, when last heard of, this man was investigating the machine tool industry and the tree is still standing!

The Electrical Wiremen and Contractors Act is, I think, an example of such legislation which set out to gain absolute control of electrical wiring i.e. registration of every person who as much as touched a conductor during installation and the inspection, by the suppliers, of every bit of wiring work done in their areas of supply. Notwithstanding the valiant efforts of departmental inspectors, and those of local authorities who, in the pursuit of their query — the illegal wireman — strove to disguise themselves to resemble street lamp posts or casual members of the public, more often than not failed to secure a conviction and today it can confidently be said that a very large slice of wiringwork indeed is done by unregistered persons aided and abetted by all concerned.

On the other hand, suppliers soon found that there is a very definite limit to the number of inspectors they can employ and pay, with the result that the inspection of all wiring work within their areas of supply became a physical impossibility. The findings of the Wiehahn Commission of Inquiry into Labour Legislation on this Act are now well known and its recommendations have been welcomed by most responsible bodies with a sigh of relief. With the assistance of your association and other interested parties it is hoped to strike a better balance between safety and control in the proposed regulations on electrical installations to be promulgated under the Factories Act.

This brings me to another point that bears consideration and that is the question of how to accept responsibility without attempting to institute absolute control. I have already had a few very interesting arguments with people in authority who maintain that they will only accept responsibility for something if they can actually sit on everything and everybody concerned and if this is impossible they cannot see how they can accept any responsibility at all!

It would be extremely dangerous for me to even try to lay down any guidelines but I can only point out that it should be possible to accept responsibility for something provided reasonable steps have been taken to control that something. Reasonable steps could be defined as those which a reasonable man, taking all relevant factors into account, acting carefully and judging objectively, would take if presented with the same set of circumstances. It transpires that those people who are reluctant to accept responsibility confuse getting into a court with being found guilty by a court. It is my opinion that a truly responsible person would have the courage of his convictions to defend his actions against all comers, even in a court of law!

Mr. President, I wish to thank the Convention for giving me a hearing but, before I close, I want to say that many a legislator sets out to create order out of chaos only to find out later that through some quirk of fate chaos ensues. This situation is very succinctly epitomised in the following two quotations:

In lauding Newton, Alexander Pope's epitaph on him acclaimed Newton's contribution to science and the understanding of the Universe in the following very fitting lines:

"Nature and nature's laws lay hid in night,  
God said 'Let Newton be' and all was light."

Sir John Squire, no doubt frustrated by Einstein, answered this one with:

"I did not last: The Devil howling 'No:  
Let Einstein be!' restored the status quo".

I hope Mr. President that my name will not one day be substituted for that of Einstein when people survey the safety legislation and its administration in my term of office!  
Thank you.

#### MR. E. DE C. PRETORIUS: POTCHEFSTROOM

Mr. President, when you invited me to open the discussion on Mr. Weich's address I, at that stage, did not quite realize that I actually had joined the fraternity of guys who rush in where angels fear to tread, as I could so easily land myself on thin ice or get myself confronted by a man who, although his name means soft, can become rather ruthless when one neglects one's homework! Nevertheless, it is indeed a great honour to do so and I will endeavour to do justice to an excellent paper and its eminent author.

'n Ietsie oor die referent: Mnr. Weich is in 1921 — glo dit as u wil! — in die VSA gebore terwyl sy vader, 'n predikant, daar verstedelike het. As pastorieuseun (en die agtergrond is seker die belangrikste bydraende faktor dat mnr. Weich nog steeds 'n goeie Christen is, en ek sê dit met die grootste agting) het Augustus Alfred o.a. in Callitdorp en Kenhardt grootgeword om ná matriek in die meganiese ingenieurswese te studeer aan die Universiteit van Kapstad, wat baie vooraanstaande ingenieurs opleewer het (totdat die Maties begin oorneem het!) Mnr. Weich vertel graag die verhaal van een van sy professore wat in sy finale jaar aan hulle klas geesê het — (ek hoop ek het dit reg): "Next year you will become engineers; some of you will become good engineers and earn a thousand pounds a year."

Na sy universêre loopbaan sluit hy hom aan by die SAS as meganiese ingenieur en hy ontwerp 'n aantal nuwigedige vir stoomlokomotiewe. Ek verstaan hy was 'n regte "fundi" op hierdie gebied. Daarna bekeer hy hom in die milieu van krygs- tuigontwikkeling. Maar heelwaarskynlik sy grootste monument was die mobiele veldkombuis wat hy van niets af ontwerp en ontwikkel het: dit was die eerste in sy soort in die wêreld en word vandag nog net so gebruik.

In 1965 tree hy in diens van die Department van Arbeid as Adjunk-hoofinspekteur van Fabriekke en word in 1978 bevoor- der tot Hoofinspekteur, 'n pos wat hy met groot onderskeiding beklee. Dit in kort wat die referent betref.

The word "idle" appears twice in the title of Mr. Weich's paper. Idle, according to my dictionary — it is a very up-to-date one because it contains all the four-letter words! — means: doing no work, not employed, not active, not in use, avoiding work, lazy. Mr. Weich no doubt must have chosen this title with his tongue in his cheek unless he was mindful of what Jerome K. Jerome said in his book "Idle thoughts of an idle fellow": "It is impossible to enjoy idling thoroughly unless one has plenty of work to do."

Dit is 'n groot goed om van mnr. Weich te verneem van sy waardering vir die noue band en die hartelike samewerking wat daar tussen ons, die VMEQ, en hom bestaan. Ek is een van die paar bevoorregtes wat al verkeie kere op intieme vlak namens die VMEQ met mnr. Weich beraadslaag het en ek kan konstateer dat daar lanklaas, indien ooit, so 'n weder- sydsse vertroue tussen die VMEQ en die Hoofinspekteur was en glo dit is slegs tot heil van beide partye; ek hoop dit sal so voortduur, selfs nadat mnr. Weich afgetree het. En wat 'n genot is dit om met 'n persoon saam te werk wat so prag- maties is (al tik hy jou soms op die vingers, en tereg ook, as jy nie jou huiswerk gedoen het nie); hy staan met sy voete van op die grond en is nie 'n verstekte wet- en regulasie- maker en letter-van-die-wet man nie, soos dan ook blyk uit sy referaat.

It is gratifying to know that we have a Chief Inspector of Factories who is conversant with the Law of Diminishing

Returns, which is so appropriate to safety legislation. (His amusing story about the fellow who was given the job of felling a tree must have reminded many of us of that gem of a ballad: "There's a hole in the bucket, dear Henry, dear Henry!") He refers to the imminent abolition of the archaic Electrical Wiremen and Contractors Act. To me this is a personal realisation of an ideal cherished for many years, which takes me back to 1966 when, at the very first Technical Meeting of the AMEU (in Bloemfontein), I advocated such a move, to which the then Chief Inspector retorted: "Over my dead body." Here again we owe our indebtedness to Mr. Weich's pragmatism.

Mnr. Weich raak 'n baie teer punt aan, nl. die kwessie van verantwoordelike, ek neem aan in konteks van die Wet op Fabriekke, Masjinerie en Bouwerk, en dat daar so maklik daarvan weggeskram word, iets wat hom blykbaar veront- rus. Is die rede vir die skueid om verantwoordelike te aan- vaar nie moontlik daaraan te wyte dat sommige inspekteurs van die Departement van Manekragbenutting, in die geval van 'n ongeluk, veral 'n noodlotlike ongeluk, skynbaar onver- biddelik, ongenaakbaar en hulle optrede, weer eens skynbaar, vervolgsugtig en subjektief gekleur is nie? En dat 'n onskul- dige persoon in die hof kan beland nie? Ek self het een keer die onaangename ondervinding gehad om tereg te staan op 'n aanklag van strafbare manslag — dit is slegs een graad minder ernstig as moord — a.g.v. 'n noodlotlike skok wat 'n seun in 'n substasie opgedoen het nadat, so bet die hof bevind, hy en sy maats vermoedelik daar ingebreek het. Die hof het my onskuldige bevind, ook aan gewaande oortreding van regu- lasies onder die Fabriekswet, maar dit nadat ek en my vrou amper senuwrakke was en regskote vier syfers behoop het. Dan begin 'n mens wonder of dit die moeite werd is.

Ek voel sterk daarvoor dat ondersoek na noodlotlike onge- lukke, waar 'n verantwoordelike persoon in die gedrang kom, voor een of twee assessore wat 'n soortgelyke posisie as die betrokke verantwoordelike persoon beklee, moet plaasvind want nie alle inspekteurs is 'n Gus Weich nie.

Mr. President, in conclusion I refer to the very last paragraph of Mr. Weich's paper in which he expresses a hidden fear of eventual negative evaluation of what he has brought about. Let me say this, without fear of contradiction, that "thou shalt not fear" because we will always remember you, Mr. Weich, in the words of the same chap who wrote Newton's epitaph: "Thou wert my guide, philosopher and friend." And I am convinced that, in your years of retirement and when looking back at your present office, you will be able to use the words written by Newton in a letter to Dr. Bentley: "If I have done the public any service, it is due to patient thought."

In saluting you, our guide, philosopher and friend, it is indeed a great honour to propose a vote of thanks to you for your not so idle thoughts and your greatly valued association with the AMEU.

#### MR. C. ADAMS: PORT ELIZABETH

Mr. President, Mr. Weich's thoughts on Industrial Safety Legislation are like a breath of fresh air and really give one hope for the future. His refreshing outlook on safety legislation can only be applauded, and I wish him long life and more power to be his elbow.

The main problem relating to safety is that it is unfortunately a very subjective term, and what may be considered perfectly safe by one person may be very risky to another. Luckily Mr. Weich appears to be awake to this problem, as he said, "Statu- tory control must look after the safety aspects satisfactorily, but not hamper progress."

I heartily endorse Mr. Weich's views on ultimate control, and the impossibility of legislating for 100% safety. Unfortunately in South Africa in the past, the Government's approach has been to control virtually everything by legislation and I am sure that if the legislators were given their heads, the safety legislation would be so restrictive that it would be impos- sible to do any work. I sincerely hope that Mr. Weich succeeds in getting his 20/80 ideas across.

One thing that perturbs me about the way legislation is drafted, is the lack of consultation. Mr. Weich assured us that bodies such as the AMEU would be consulted, but I would appeal for a change in the method of consultation. When laws are drafted this is done very much in isolation by Gov-

ernment departments and their legal staff, and the draft bill is then published for comment. Usually only one month is allowed for comment, which is very much too short for a major Act such as the revised Factories Act will be. The comments are then studied by the Government department and, very often, no change is made to the Act.

I would like to see amendments to the Factories Act handled in the same way as the SABS handles the preparation of standards, by the creation of a committee embracing all interested parties, who then discuss, query and alter the various clauses, until a draft is finalised which is generally acceptable to the majority of people. For the safety legislation the Committee should include organisations such as the Chamber of Industries, Chamber of Mines, Building and Civil Engineering Industries Federation, AMEU, etc., etc. With this system each organisation has a far greater opportunity to comment and influence the course of events, because comments are made at meetings and can be more fully discussed than it is possible to do by way of written comment on a draft act.

In conclusion, I may say that I am awaiting the new Act with interest and would thank Mr. Weich for giving us a glimmer of hope that it will be a progressive piece of legislation. Thank you.

#### MR. I. BOYACK: PRETORIA

Mr. Weich's point that the regulations must be formulated in such a way as not to stifle technological advance is valid. However the statement that this flexible attitude must not be built into legislation unless the implications of the developments are known can, in practice, sometimes be difficult to achieve. How often does one not hear the statement, after the failure of equipment or after investigation has indicated that a particular item of equipment is at risk, that the equipment was designed and built to the best standards and engineering knowledge available at the time. Pretoria certainly has expensive first hand experience of this situation. Under these circumstances the transfer of knowledge is extremely important and it is suggested that this transfer of knowledge and experience could be improved by more informal group discussions on a workshop pattern.

Statutory control provides for the safety aspects. However the maintenance of equipment to a satisfactory standard is becoming extremely difficult in view of the lack of experienced staff and the high turnover rate in certain municipal electricity undertakings.

In conclusion Mr. Weich must be congratulated on his efforts in formulating regulations for electrical installations to be promulgated under the Factories Act. This will make provision for limited inspections to be carried out by the supply authority, and will to some extent relieve the difficult staff situation. Thank you.

#### RDL. C. VENTER: JOHANNESBURG

Mnr. die President, ek wil dit vir u baie duidelik stel dat ek heeltemal saamstem met wat mnr. Weich hier gesê het en ek verwelkom sy nugter denke in verband met Veiligheidswetgewing. Daarmee het ek geen fout te vind nie. Ek kan egter nie aanvaar dat mense wat daartoe gekant is, verantwoordelik is nie. Ek dink byvoorbeeld daar is verantwoordelike mense wat hulle ook verset het teen die afskaffing van die Wet op die Elektrotegniese Draadwerkers en Aannemers. Nou hoor 'n mens jy moet jou huiswerk doen voordat jy kan praat met mnr. Weich. Ek weet nie presies wat daarby bedoel word nie. Ek het vier kinders — kwalifiseer ek nou?

Mr. President, just three questions to Mr. Weich: firstly, if they cannot include that in the Factories Act, will the provisions of Section 57 of the Amendments to the Industrial Conciliation Act only be placed into operation when the provisions of the new Occupational Health and Safety Act comes into operation?

Secondly, there is a strong feeling that (a) the registration of wiremen, in terms of the new Act, should be the responsibility of the industry concerned and not necessarily be a Government function, (b) there should be a national register of Electrical Contractors, and that should also be the function of the industry. I say the Industrial Council should handle that and so alleviate the stress and strain on the Government. I do believe that when the industry controls itself, a lot will

be done to get greater acceptance of the safety regulations. Thank you.

#### MR. J. V. GRANT: SABS

Firstly, may I say I did enjoy your talk, Mr. Weich, very much as usual.

When the wiring code is made compulsory, we are going to have the following position:

The Code states that all electrical equipment, every item of electrical equipment, in an electrical installation, must comply with the applicable specification.

At the moment this rule is rather ignored. It was, in fact, in the wiring regulations and was never taken too seriously. When we come to face the law, it might be a different position.

First of all, the Bureau of Standards is going to be, perhaps, in a little bit of trouble. Our resources are going to be strained if we are going to have a lot of equipment for testing. We are, ourselves, approaching manufacturers in this respect.

But what I am now asking you, Mr. Weich, is, will there be a period of latitude to allow people to comply with the relevant specifications? Thank you.

#### MR. DENNIS KNEALE: ECA

We welcome the decision to scrap the Electrical Wiremen and Contractors Act. We believe that it has been more protective to the artisan than the contractor himself; in fact, it's been a piece of legislation that has caused a lot of aggravation to contractors in the past.

We also believe that the Industrial Council should have no say in the persons who are registered to supervise test and commission work. We believe that this is a function of the Government and, as far as the Industrial Council's having a say in the registration of contractors, is concerned, we would not go along with that. Thank you.

#### MNR. A. A. WEICH: HOOFINSPEKTEUR VAN FABRIEKE

Meneer die President, eerstens wil ek graag baie dankie sê aan die sprekers vir die pragtige woordte wat hulle mi toege-swaai het. 'n Mens moet altyd versigtig wees by 'n begrafnis wat jy van die dooie sê, want partykeer ken jy hom nie.

Ten eerste, mnr. Pretorius, wat die punt opgehaal het van vervolging. Nou wil ek net sê dat ek baie jammer is vir die persoonlike ondervinding wat hy gehad het, maar die Departement stel nie vervolgings in nie, maar wel die Prokureur-Generaal. Die Departement met die beskikbare getuies lê dit voor aan die Prokureur-Generaal en hy besluit of daar 'n saak is, al dan nie. Die houe besluit dus of die persoon skuldig is of nie.

Mr. Adams has suggested that there should be more consultation in the drawing up of this type of legislation. I would like to assure Mr. Adams that we consulted widely. We are at the moment drawing up regulations for electrical wiring. Now the draft has been prepared in full consultation with the AMEU and several of the Municipalities. Obviously one cannot make a committee like that too big, because you know what happened to the horse that was designed by a committee and turned out to be a cow.

Mr. Boyack has suggested more formal group discussions. Unfortunately Mr. Boyack, as much as I would like to see more group discussions between industry and users and the Department, we are only a very few people and we find that our time is cut out in administering the Act from day to day. We try to consult as widely as possible, but until I have larger staff, and unfortunately I am in the same position as you, that will be impossible.

is dit die voorneme om nie die Wet op Elektrotegniese Draadwerkers van die Wetboek af te haal alvorens die regulasies, wat in opdrag van die Regering onder die Fabriekswet moet kom, klaar opgestel is nie. Dit is nou in die proses om te gebeur.

Ek weet almal verwyrs hier na die Staatskoerant waarin 'n ander Wet afgekindig is met die voorneme om hierdie Wet te skrap en hom onder die Wet te plaas. Meeste mense lees nie die Staatskoerant klaar nie — ek wil net sê 'n mens moet jou huiswerk doen — en dit sê vanaf 'n datum wat deur die

Staatspresident afgekondig sal word, en dit is waarop dit eintlik neerkom. Die Staatspresident sal nie die skraping van die Wet nadat die Parlement dit goedgekeur het afgekondig alvorens die regulasies nie klaar is om ook afgekondig te word nie en dit sal gelyktydig geskied.

Oor die aspek van wie die hele klomp moet beheer, gaan ek nie nou op in nie. Ek is baie jammer, die Wiehahn Kommissie het homself daarop uitgelaat in die Witakrif wat baie duidelik sê wat gedoen moet word. So ek sal nie nou in 'n debat hieroor betrokke raak nie.

Mr. Grant, whether there will be a period of latitude, as you've heard from my speech, we are latitude. Thank you.

#### MR. D. H. FRASER: PRESIDENT

Thank you Mr. Weich, you have fully justified the confidence we placed in you in providing us with an address that was entertaining, informative and thought-provoking. In asking you to accept a tie bearing the AMEU emblem as a token of our appreciation, I would suggest that you pack it with your baggage and, if you don't find the opportunity to wear it when you are in Paris, perhaps when you visit Princess Grace for your afternoon tea in Monaco it would be the appropriate apparel to wear. Thank you very much Mr. Weich.

## CLOSING SESSION AFSLUITINGSSIE

#### MR. D. H. FRASER: PRESIDENT

Madam Mayor, distinguished guests, ladies and gentlemen we are honoured Madam Mayor that you and the Mayoress have made time to be with us at the closing session of this Convention, knowing what heavy demands there are on your time. The return of the ladies, too, adds colour and beauty to the scene and, with due deference to the conscientious male delegates who have been sitting in front of me for the past three days, distinctly improves the view from the main table.

I trust that you have enjoyed your programme and spared an occasional thought for your men folk hard at work back here.

We have now come to the final run-down of the Convention when, perhaps with a twinge of sadness, we draw proceedings to a close in a routine which has almost become a tradition in the AMEU.

I would like first of all to invite Her Worship the Mayor of Durban to say a few words on behalf of the host City.

#### HER WORSHIP, COUNCILLOR MRS. S. C. HOTZ

Mr. President, President Elect, Ladies and Gentlemen, if you look at the programme you will see that the closing session is due to commence at 15h45 and there are four speakers, the final item on your programme is 20h00 — that gives each of us approximately just over one hour for our closing addresses. Please don't have any fears about my going on for an hour as today I am feeling particularly sensitive about lengthy speeches. Just as an opening ceremony is filled with a sense of expectancy — closing something is tinged with a little sadness, for it brings to an end whatever was looked forward to by so many, but I am sure that you will all take away very many happy memories. I should like, on behalf of Durban, to say thank you for coming here for your 47th Convention. I should also like to say thank you to the many sponsors who helped to make the Convention the success that it was. I say success, Mr. President, because you have had a fair amount of radio and press coverage which I have followed closely.

Closings are also times for congratulations and it is very

fitting that the organisers of the Conference receive acknowledgement, for a Conference of this magnitude with so many delegates does require a great deal of expert organisation so, on behalf of Durban, may I say thank you for a job well done. Anything that is successful will always have women involved and to those women who very obviously worked so hard behind the scenes I am sure the men have appreciated your efforts.

I have today perhaps a far greater understanding of the whole of our electrical undertakings not only in Durban but in South Africa and it cannot be denied that, in the development of our country from being of the third world to the highly industrialised nation that it is today, electricity has played a very vital role. That role Mr. President will continue to grow as the demands for energy necessary to meet the need of the future have to be met. This is why this Convention has been of as great importance as your past Conventions have been and those in the future will be.

Mr. President, I make this appeal to your organisation and that is, when you look to the future and future Conventions, don't lose sight of one of the most vital areas which has been overlooked in the development of our country and that is electrical reticulation in the black areas round us. I said in my welcoming address that I am fully aware of what is being done in Soweto and the cost, but at the same time I ask the question, what about the rest of the black areas on the outskirts of our cities. Are we not hoping to solve problems in one area at the expense of another?

We as a City Council supported by our officials would welcome the opportunity to provide the expertise that is needed to provide this facility round our own city, but it needs capital expenditure which local authority budgets do not extend to and I take this opportunity to appeal to central government to try to find the financial aid that is required even if we can all only start in a small way.

When I welcomed you all to Durban, I did remark that there were more wives at the Conference than one usually sees. It has been a pleasure to host you all and Durban may take it as a compliment that so many of you came. Being a wife and mother, I know it is not always easy to get away from home and your presence has added a touch of glamour and graciousness and helped to create the very happy atmosphere that has prevailed. The natural instinct, I know, is to rush home at the end of a Conference, but I do hope that many of you will be present at the final event — the ball at the Country Club.

To Denis and Val, best wishes for your term of office and, on behalf of us all, I wish you both well and every success, and to you all may God go with you on your journeys home to your loved ones.

## CLOSING ADDRESS ON BEHALF OF AFFILIATES

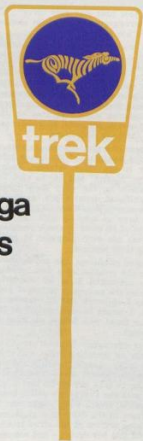
### AFSLUITINGSWOORDE NAMENS DIE GEAFFILIEERDES

#### MR. D. H. FRASER: PRESIDENT

It is now my personal joy and privilege to call upon Honorary Member John Morrison to deliver the closing address on behalf of the Affiliates. When I first asked John to perform this function I was devastated to learn that he had a prior commitment, because, to me, his part in previous Conventions has been one of the highlights.

Thank you John for somehow managing to stay with us until today and for agreeing to speak for the Affiliates. You will of course know that your old sparring partner, Matt, will follow you at the rostrum and will have the last say, so choose your words carefully.

**Trek in by die kwagga  
Maak vol met trots**





Mr. J. A. Morrison.

#### MR. J. A. MORRISON: AFFILIATE

Mr. die President, Mevrou die Burgemeester, dames en here, toe ek gister op die strand sit, moes ek 'n lewensredder se aandag daarop vestig dat daar 'n dame in die moeilikheid is. "Moenie bekommer nie", antwoord hy. "Ek het haar al vier keer gered, maar haar man gooi haar elke keer terug".

Wel ek is al veertien keer teruggegooi met hierdie slottoespraak so ek verstaan presies hoe sy voel.

Throwing my mind back to this speech at an earlier Convention, I recall that I offered a survey of the different styles of Management that were then available and suggested that, in times of business recession, the "Mushroom Method" was often employed. This system operated on the basic principle of keeping all staff completely in the dark, whilst showering them, at regular intervals, with fertiliser. As a natural consequence, it followed that salaries were restricted on the lowest level on the excuse of saving personnel the embarrassment of having to work out their tax deductions.

However, during the short space of a single decade, conditions have changed radically and the pendulum of the labour market has swung dramatically to the other extreme. Today, Management is no longer the "Master" and has to seek the approval of the lowliest moron on the shop floor before making even the most insignificant decision and, as far as terms of employment are concerned, Departmental Chiefs are working their heads to the bone to keep up with calls for more money and the provision of all sorts of exotic facilities, before the potential employees are even prepared to grant them the honour or soliciting their services.

How then, under these changed conditions, can any business survive? The answer lies in the creation of a new breed of managerial supermen — a proverbial team of wonderful white winged warriors on whom the success or failure of your business is poised — and, as I approach the culmination of my own career, I feel that it would be appropriate to lay down certain guide lines, for those who follow, on what to look for in these celestial beings.

Heading your team is your Managing Director or Chief Cover-Upper who immediately on accepting office will delegate every shred of responsibility, thereby astutely shifting the possibility of any blame. Conversely he will be readily available at a moment's notice to take any credit that might be forthcoming. In keeping with the Company's public image — he will, at enormous expense, create what might best be described as an attractive front in the form of a glamorous secretary — who every morning arrives at the office looking as if she had just been poured into her dress — and someone had forgotten to say when!

Our next key executive is the Financial Director, as it is on his success in manipulating your trading results that the most important declaration of the year can be made — namely whether there will be a Christmas Bonus or not.

He is the only chap in the Company who is allowed to use the scientific calculator referred to in Dennis Paisler's excellent paper, but sadly in the past his mathematical meanderings with this gadget to establish the "Discounted Profit" has inevitably produced results that have been quite disastrous. Indeed — I was once with a company where the shares were so low that you had to go into a special decompression chamber in order to read the ticker-tape.

The Production Director is a MUST, in that he is the one member of the Board who can tell you where to find the factory. In his job, good labour relations are of paramount importance and the first two hours of every day have to be devoted to ensuring that all employees are happy, warm and comfortable and not too inconvenienced by the early start. Our director is also responsible for security and, one evening, he drove round to the factory to find two gentlemen cooking their supper over a roaring fire. "Who are you?" he enquired "Boss, we are the Nightwatchmen" — "and what do you watch?" — "We don't know Boss — its too dark to see".

His Chief Assistant is the Works Study Engineer, the Hatchet Man, whose principle objective in life appears to be to slash the numbers of personnel to the minimum level at which it is then physically impossible to operate. Let me tell you about one of these fellows who was given two free tickets for the performance of Schubert's Unfinished Symphony. The next day when asked how he enjoyed it he answered "Alright I suppose, but for considerable periods the oboes had nothing to do — then all twelve violins played identical notes and finally and for no useful purpose, the horns would repeat the same passage already played by the strings. Now, if only Schubert had cut out all this unnecessary work, he could have reduced the Symphony from 2 hours to 20 minutes and probably had time to finish the job".

Last, but not least, you have the Sales Director — that amiable character who exudes largess and whose sole interest is to make you — the customer — happy. This he does by offering the finest equipment at "give away prices" and with delivery promises that are quite unbelievable! He radiates confidence and a light hearted goodwill until that dreadful moment when you ask for technical details — at which stage his countenance assumes a hurt — hangdog expression indicating that your question suggested that he didn't know what he was talking about. I had a case only last month when I was being subjected to a racey catalogue on the attributes of electronically operated garage doors. "O.K." I interjected "but how do they work?" For a moment there was a horrid silence and then with a sort of pitying smirk our friend replied. "Mr. Morrison, I am not going to waste your time with highly scientific detail — sufficient to say that all you do is to press the button on your dashboard and the doors lift up — mind you, in the case of your wife, she doesn't even have to do that — for when they see her coming up the drive, they fly open in sheer terror".

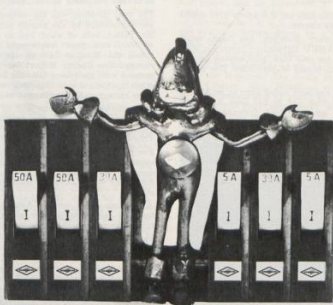
Such are the refinements of modern technology!

Mr. President, you will have noticed that I have deliberately devoted this occasion to aspects of Commercial Management, but in view of the comments made in your Address it would seem that some of your Members are presently thinking of deserting the calm and placid waters of the Municipal or Supply Electrical Engineer for the turbulent and stormy life of the Affiliate.

May I implore them not to be so tempted. We have enough "Princes of Industry" out of their depth already and quite honestly the life guard is fed up with pulling them out.

Finally, as this could well be the last occasion that I will speak on behalf of the Affiliates — I am feeling rather like Lady Godivier who, as she approached the end of her journey, was heard to remark "Thank Goodness — I am nearing my close". However, before doing so, may I congratulate you Denis on a wonderful Convention. The organisation has been outstanding — thanks to you personally, your staff and our efficient and untiring Secretary — Bennie van der Walt; the high standard and excellent presentation of the papers has added lustre to the occasion and the hospitality extended to us by the Mayor and the Councillors of the City of Durban has been just fabulous.

On behalf of us all — Thank you.



## The year of SAMITE

During 1980 the new SAMITE Range of domestic electrical distribution and protection products, developed in South Africa by Heinemann, is being introduced in a planned series of phases.

The first phase introduces hydraulic magnetic circuit breakers up to 50 Amps, 2,5 kA, and 60 Amp switches all in single, double or triple modules. Each module is only 13 mm wide and saves up to 48% of the space on most panel boards. They will be available shortly together with single phase earth leakage circuit breakers up to 50 Amps, 2,5 kA, SP and neutral common trip, lightning arrester and a board-mounted timeswitch. Minirail mounting, adaptor plates, busbar links, etc will be available for the easy integration of the SAMITE range into standard CD/CF clip trays.

Subsequent phases will introduce higher rated SAMITE circuit breakers and switches and 5 kA ELCB units.

Ask Heinemann for literature on the full SAMITE range.



P.O. Box 881, Johannesburg, 2000  
 Tripswitch Drive, Elandsfontein  
 TA: Tripswitch Johannesburg  
 Telex: 8-6372 SA. Tel: 36-7033

**Samite — South Africa's breaker for the space age.**

*Synell Distributors & Associates 1601*

## CLOSING ADDRESS ON BEHALF OF THE LADIES

### AFSLUITINGSWOORDE NAMENS DIE DAMES

MR. H. D. FRASER: PRESIDENT

And now the man with all the luck or, if I am to give credit where it is due, I should say charm.

Mr. Pat Middlecote, Honorary Member, has been voted "Ladies Man" of the 47th AMEU Convention (even his wife Peppy voted for him) and for this high achievement he has the privilege of speaking on behalf of the ladies this afternoon.

This is not the first time he has been called upon at an AMEU Convention to perform this task and he has done it so well in the past that we all, I am sure, look forward to some words of wit and wisdom.



Mr. A. A. Middlecote.

MR. A. A. MIDDLECOTE: SABS

Mr. President, Ladies and Gentlemen, I was very honoured when I was asked to give the closing address on behalf of the ladies. I have a great admiration for that hardworking bevy of beauty who attend this Convention and welcome this opportunity to destroy the myth that they are just here for pleasure — they come here to work just like the rest of us. That is possibly the reason why my wife is attending for the first time for 25 years. No — don't be misled by the mannequin parade, the Mayoress's Tea Party, or the visit to the domestic science department at the ML Sultan Technikon. These were but short breaks in a very busy period.

This year the ladies, under guidance of Val Fraser and Iona Barnard with economic guidance from Diana Palser decided to undertake some electrical engineering research to back up their spouses.

They were at first a little upset when they heard the presidential address and the need to be a certificated engineer under the Factories Act before undertaking certain duties, and the need to be a Professional Engineer before undertaking work reserved for a Professional Engineer. However, they decided that anyone who could remain married to a city or town electrical engineer must be certified if not certificated. Also, clause 18(4)(b) of the Professional Engineers Act of 1968 allows for registration of any person who has

had not less than 25 years practical experience in work normally performed by a professional engineer. Now it is felt that certain of our ladies have certainly been doing their husbands' work for them for over 25 years and they must surely qualify under this clause 18(4)(b) — commonly called the "grandfather clause".

But Mr. President, the feminists among them, in particular the Mayor of Durban, object to this male chauvinistic term and wish you to take the matter up with SACPE and ask them to change the name to the "grandparent clause".

The next problem was the subject for their research. They were impressed by the papers presented by Mr. Gorven and Mr. Palser, both of which had an economic flavour. The title of Mr. Yates' paper encouraged them to be practical. The stress the Minister laid on the need for conservation of energy. The Energy Report and the Solar Energy Report coupled with the recent Cahorra Bassa supply failures finally made up their minds that they would investigate practical solar energy and its economic implications.

So Gentlemen, if you saw any of our lovely ladies lying on the beach or next to the swimming pool exposing their glorious forms to the sun (and father) they were not lazing. They were participating in solar energy investigations.

For the information of the uninformed, solar energy can be obtained in two ways. First, directly from the sun and secondly by ingesting or processing biomass — a lovely word for plants which store the solar energy they obtain from the sun.

As regards direct thermal conversion which our ladies obtain by lying and exposing their collective areas to the sun's rays, it was found that this area varied considerably. Some ladies of Junoesque stature had a maximum possible collective area of 0,7 m<sup>2</sup> while the more delicate had a humble 0,25 m<sup>2</sup>. The average was found to be 0,33 m<sup>2</sup>.

From this maximum value, a certain percentage has to be subtracted to allow for screening, such as bikinis, of certain parts of the body which our laws unfortunately insist upon. This value also varies considerably with the individual. For the verkrampte it is 35%, for the verligte 5% and for the progressive 2%. The average was found to be 10%.

This means that the average collector area of our ladies is 0,3 m<sup>2</sup>. At the current price of R300/m<sup>2</sup> for collectors, this represents a capital outlay of R90,00. And what do we get for this?

The average solar energy absorbed by a collector is 25 MJ/m<sup>2</sup> per day. Thus if our ladies do a day's work they will have directly absorbed, converted and stored, some 7,5 MJ or in units to suit electrical engineers, 2 kWh. At an efficiency of 75% this means a net 1,5 kWh of energy.

And now for the biomass intake of solar energy. First of all, Natal is famed for its sugar cane — an enormous source of biomass but hardly to be eaten by our ladies. Fortunately, it is available in a liquid form — to wit — cane spirits. This can be taken preferably as a sundowner to make up for the loss of direct solar energy that ceases at sunset.

Here again there is a variation. The progressive lady can absorb up to 8 metric tots, the verligte 4 and the verkrampte barely 2. An average was found to be 3 metric tots which represents 0,25 kWh of solar energy.

Then one has to consider Natal's national fruit, the banana — an excellent form of solid biomass and one easily ingested. Here again we found a large variation. Some could cope with an intake of 1 kg of bananas a day, others as little as 100 g. An average was found to be 250 g. Since bananas have a solar energy content of 850 kilogram calories or 3,55 megajoules per kilogram this means that the average solar energy intake per day from bananas is 0,25 kWh.

Gentlemen, the ladies have shown that they can on an average convert and store 2,0 kWh per day if allowed to lie in the sun long enough, eat enough bananas and drink enough cane. This energy they can use to make up for ESCOM's shortcomings and in particular during peak hours. In bed they can keep hubbie warm. The average electric blanket — the most efficient heating agent — consumes about 0,8 kWh per night and this can now be supplied by the wife leaving a net 1,2 kWh for other essential domestic duties such as beating eggs and baking cakes. Do away with the necessity to switch off road lights, as suggested by Carel Venter.



Unfortunately this Convention is that type where one simply just cannot get to bed. Consequently our ladies will be returning tomorrow with some 4 kWh of stored energy in reserve. Gentlemen, you have something to look forward to. Wait till you get home.

Mr. President, the ladies are very thankful for the opportunity given them to study solar energy. They feel that their work could help ESCOM engineers considerably as regards the siting of their first solar power station. They feel that if they had been consulted regarding the siting of the first nuclear station there would not have been the outcry there has been from Cape Town. Let not the same mistake be made as regards solar power.

It is with this in view that they would recommend that the next Convention be held in Cape Town. You know Cape Town has bigger and better things than either Durban or Johannesburg. Big mountain, Big wind. But above all they have a super pumped storage plant at Steenbras which is the envy of both Carel and Wessel of Johannesburg and the Mayor and Denis of Durban. With this knowledge Denis and Frank just smirked when the Mayor and Carel were vying with each other. Actually in strict SI units he can store 2 000 Megawatt hours. But in woman power units this represent 500 000 woman power hours. So you see he can also boast that he has the largest electric harem in the country.

It is with this in view that they would recommend that the next Convention be held in Cape Town. The cane spirit would have to be replaced by Cape brandy but this has a higher solar energy content per tot and there would be a gain. Bananas are not readily available in the Cape but grapes — particularly hanepoot grapes are. Unfortunately the energy content per kg is slightly lower than that of bananas but this is more than offset by the reduction in the pollution problem. Bananas constitute a definite pollution threat. After all what does one do with the skin? The ladies, especially the progressive ones in their bikinis, found it very difficult to find a place to tuck away the skin. Grapes on the other hand can be swallowed pips, skin and all.

Finally, and more important still, if the Convention could be held in Sandy Bay there would be a decided increase in the direct thermal conversion of solar energy. There would not be the average loss of 10% of collective area necessary in Durban thus increasing the energy storage. There would also be saving in capital cost of the screening such as bikinis.

Mr. President, the ladies would like to confirm practically their conclusions and recommendations that the first ESCOM solar power station be sited at Sandy Bay, Cape.

With that I would now like to thank you on behalf of the ladies and congratulate you on a very successful Convention.

## VOTES OF THANKS AND CLOSING OF THE CONVENTION BEDANKING EN AFLUITING VAN DIE KONVENSIË

### MR. D. H. FRASER: PRESIDENT

Madam Mayor, honoured guests, Ladies and Gentlemen, the time has come to bring proceedings to an end.

The events of the past three days are the culmination of months of planning and preparation in which many people have been involved. And of course many more people have been involved in the Convention proceedings themselves, some under the spot light and lots behind the scenes.

In identifying persons and organisations who have contributed to the success of any function one runs a serious risk of inadvertently omitting one or two and thereby causing hurt feelings. At the outset, therefore, I want to say a very warm and sincere "Thank You" to all of you who by your willing help and support have made the President's impossible task possible. Not only possible but enjoyable and an event which will bring back happy memories in years to come.

To you Madam Mayor and to the Durban City Council, I must express the gratitude of the AMEU Executive Council and

all the delegates and their ladies for being host to this 47th Convention and for entertaining us at the delightful Cocktail Party on Monday night. A very sincere word of thanks to you personally Madam Mayor for giving so generously of your time to attending our proceedings. Your friendliness and charm have brightened each session at which you have been present and explain your current popularity as a TV star.

My very sincere appreciation too for your support and encouragement to me and Val at all times and as a token of our esteem and an expression of thanks from all the delegates, we would ask you to accept a small gift to remind you of this occasion. It is a set of dinner mats especially woven for you to a design drawn by a talented young lady on my staff, Miss Leigh Perch, who I would ask to come forward and make the presentation.

One of the highlights of the ladies programme was undoubtedly the Mayress' Tea Party at the Killie Campbell Africann Library. Mrs. McMillan you were an attentive and gracious hostess and on behalf of the ladies I thank you most sincerely for your hospitality. We would also like you to have something to remind you of the AMEU Convention and I have pleasure in calling upon my wife to come forward with a small work of art produced this time by the talented wife of a member of my staff, Mrs. John Hall.

The wife of the President shoulders a heavy burden both before and during the Convention and for her instigated help, encouragement and forbearance I say thank you to my wife Val. Annatjie may I ask you to make a small presentation to Val.

To Annatjie van der Walt, thank you for all the help which you so generously give on these occasions and especially the support and encouragement you have given to Val.

Two people who work throughout the year to make my life easier deserve special thanks for undertaking so willingly many extra typing and other tasks associated with the Convention. I would like my Secretaries Mrs. Campbell and Mrs. Paull to come up to the platform now so that I may publicly acknowledge their contribution to these proceedings.

Only those who have been closely involved in the organising of an event such as this Convention will know the amount of detailed planning and preparation required and the impossibility of achieving success without the assistance of a group of dedicated workers. I have been singularly fortunate in this regard. Not only have I had a band of dedicated helpers but people who, under the experienced and persuasive leadership of Mr. Alistair Whyte, have put heart and soul into the job and come forward with many novel and useful ideas. For their enthusiastic support I shall be forever grateful and I would ask Alistair to come forward with the members of his Convention planning team so that we can recognise them.

Messrs. H. H. Whitehead, B. M. Lester, F. K. Royal and S. A. J. McKellar. Mrs. S. D. Roberts, Miss L. Perch.

### MR. A. WHYTE: DURBAN

Madam Mayor, Ladies and Gentlemen and Mr. President, I think I am speaking on behalf of the Planning Committee when I say that we hope you all had a very pleasant Convention, both the delegates and their ladies. If you had any administrative problems we hope you will not judge us too harshly and as you leave Durban, we hope you go with pleasant memories. Madam Mayor, the Department felt we could not let this moment pass without some tangible evidence of the high regard every member of the Electricity Department has for Mr. Fraser, the President. The present is in the form of a wall-hanging which was designed and executed by Miss Lee Perch, it is hand-made and I can assure you this wall-hanging, rather futuristic in style, comes with the best wishes of all the members of the Department of both high degree and low. Mr. President, we have much pleasure in presenting it to you.

### MR. D. H. FRASER: PRESIDENT

Thank you very much Mr. Whyte for an undeserved gift. I shall place it in our offices for all to see.

Many other members of my staff have been involved in various other ways, some obvious and others behind the scenes. For example the lovely girls with the microphones and at the enquiry desks of on the buses have, I am sure

you will all agree, done much to brighten the scene and you would, I know, wish to join me in thanking them most sincerely. For the public address and recording we are indebted to Messrs. Dargan, du Plessis and Foley. You have done a great job.

In Speciale woord van dank aan Sy Edele mnr. F. W. de Klerk, Minister van Minerale- en Energiesake vir sy amptelike opening van ons verrigtinge.

Messrs. Gorven, Yates, Palser and Dr. Solomon for the four formal papers which contributed so much of importance to this Convention. The presence of the Chief Inspector of Factories, Mr. Gus Weich was of course extremely valuable and his talk this morning hardly deserved the title of "Idle Thoughts" which he gave it. Thank you very much Mr. Weich. The "fun" evening complete with all the trappings of the Beefsteak was one of the highlights of the Convention and grateful thanks are due to the sponsors: Aberdare, Aycliff Cables, Asea Electric, Brown Boveri, Chemilite, GEC Power Distribution, Hubert Davies Engineering, Phosware, Scottish Cables and Yorkshire Switchgear.

I must particularly acknowledge the contribution to the success of this function of Anneen Bjorjan and Dick Bellamie of Scottish Cables. On behalf of the ladies, a very big "thank you", again to Scottish Cables, for the luncheon and mannequin parade on the opening day, with special thanks in this regard to Daphne Ryan for faultless organisation in spite of a broken leg.

Also on behalf of the ladies, appreciation is expressed to Miss J. Duggan, the Curator and staff of the Killie Campbell Africana Library for a most interesting visit. This was followed by a delightful luncheon at the Durban Country Club, kindly sponsored by CuAl to whom thanks are due and especially to Mr. Jack Thomas for seeing to the ladies every requirement with such grace and charm.

And finally, the ladies have asked me to express their sincere appreciation for the arrangements made for their benefit at the ML Sultan Technikon by the former and present Rectors Dr. Alec Solomon and Mr. A. Ramsamy. They were most impressed by the College's facilities and the standard of catering and entertainment.

The floral arrangements in this hall and at the City Hall and other functions have been truly beautiful and I record our thanks to my friend and colleague Tom Linley and Mr. Blades and staff of the Parks, Recreation & Beaches Department. Thanks also to Mr. Marshall Cuthbert, Manager Transport Management Board for his co-operation and to his drivers for their efficiency and courtesy.

To the Town Clerk and especially to Mrs. Hearn and her staff in the translation section and to the typing and printing sections, my gratitude for your invaluable assistance. The Mayoral Secretary, Barry Armstrong, and his staff have been of great assistance as usual and I thank them for that. Our appreciation to the Commdt. Vic. Jearey and his staff in the City Police for their forbearance and help and also to the Director and staff of the Durban Publicity Dept.

Others who have assisted in various ways in the provision of services or requirements for the Convention include:— Siemens Ltd., for the excellent folders, pens and note paper, Specialist Contractors (Pty) Ltd. (a subsidiary of Holley Bros.), for sponsoring the ladies corsages at the Ball Mr. and Mrs. J. Hall for making the corsages, Mr. David Leeney for the photographic services, Mr. Webster, Tedex Sound & Vision (Pty) Ltd. for the closed circuit television, Mr. B. C. Odges, Musikland (Natal) (Pty) Ltd., Mr. B. Cunningham — Natal Anti Shark Measures Board, Mr. J. Secker, Beacon Sweets & Chocolates, Mr. Dredge — Mercedes Office Machines (transcription facilities), Mr. Coetze — Rembrandt Tobacco Corp., Mrs. Ray and Mr. Bloom — Standard Bank (Key rings), Perfume Design Co. (samples), Wilber Ellis — Assessors for hall decorations, The Boat Showrooms of Durban (Pty) Ltd. — For providing the yacht for decorating the hall, Neil Davidson — Provision of fish trophies for hall decoration, Nestlé Sweets & Chocolates — Provision of gift packs to be raffled, Ian Wells Trio — Provision of music at Convention Ball, Kelly Girls Services — Provision of transcription typists, Distillers Corp. (S.A.) Ltd. — Provision of Miniatures, The Durban Country Club for the CuAl Luncheon and the Convention Ball.

My grateful thanks to all of them and last but by no means least Mr. Gerhard Stanek and Mr. Fraser Bell and the staff of the Elangeni for their courtesy, assistance and efficiency throughout the Convention.

The President Elect, Mr. Wessel Barnard has been a tower of strength at my right hand for the past three days. Thank you for this Wesel and for your ready assistance in many other ways. And now the last but perhaps the most deserving expression of thanks — to our hard working and enthusiastic Secretary, Bennie van der Walt. My personal thanks to you Bennie for your support help and advice and on behalf of all the delegates our sincere appreciation, for your sterling efforts to make this Convention a success. I look forward to our closer association in the coming two years.

It is likely that there will be some among the delegates present for whom this will be the last Convention before retirement and it is fitting that we take leave of them with due recognition for their service to municipal affairs in their various capacities.

Unfortunately the records of the AMEU do not reveal the names of those concerned so I will have to ask them to stand to receive their tribute. Will those who will not be back for the 1983 Convention please stand.

To you all on behalf of your colleagues may I wish you good luck, health and happiness for the future. May God's richest blessings be yours, we shall miss you.

#### MR. H. DIXON: AFFILIATE

Mr. President, Madam Mayor, Distinguished Guests, Ladies and Gentlemen:

Shakespeare has written that some were born to greatness, some achieved greatness, but some had greatness thrust upon them. You are certainly defined by the second category and, in proposing a vote of thanks to you, Mr. President, I find myself in the third.

The tone and standard of this 47th Convention was set by the statesmanship and far-sightedness of your Presidential Address.

In your Chairmanship of the meetings, perhaps without our realising it, we have been subjected to the art which conceals art. Always with charm and with a disceptive gentleness, you have ensured that the pace and interests have never flagged and yet we have concluded a wide ranging and stimulating agenda within the three day constraint.

One could be tempted to use the term orchestration with you as the conductor but the electrical pun is not intended.

To you and particularly including your charming lady wife Val, our most sincere gratitude. You both epitomise the friendship and hospitality of Durban. The pleasure and benefit of this most successful Convention will remain in the thoughts and hearts of our wives and ourselves for many years to come.

In the discharge of our personal responsibilities, whether as the controllers of Municipal Underliakings or the suppliers who serve them, the ultimate purpose lies in the betterment of man. For the benefit of your leadership over the past over the next two years of your Presidency, we extend our three days and your public spirited dedication and example congratulations and pledge complete support.

On behalf of the delegates as a whole, to you Sir and to Dear Val, to the Office Bearers and the Administrative Staff, to the City of Durban: our heart-felt thanks.

Meneer die President, ons bedank u hartelik en wens u alles van die beste in die toekoma.

Thank you Sir.

#### MR. D. H. FRASER: PRESIDENT

And now this really is the last thank you and it goes to each and every one of you with deepest sincerity from my wife Val and from me. Thank you all for being with us in Durban — do come back again soon, we loved having you here. I hereby declare the 47th AMEU Convention closed.

Die 47ste Konvensie van die VME0 is nou gesluit.

# Shaping new worlds...

The white heat of USCO's mighty steel furnaces has spawned vibrant new industries: to help the country of its birth grow stronger; to help its many peoples live better.



USCO low voltage (600/1000 V) PVC covered cables. (SABS 150/1970). Available as 1, 2, 3 or 4 core in 4, 6, 10 or 16 mm<sup>2</sup> conductor rated areas.

## ...forging the future

AluFence from ALCOR in nine heights: 0,6 to 3,0 m supplied in 30 and 50 m rolls to 50 mm mesh size and to a diameter choice of 2,3 2,8 and 3,1 mm. Alcor also produces rust-proof tie and straining wire as well as barbed wire.

Copper from Phalaborwa . . . converted from its molten state into electric cable . . . saving foreign currency . . . bringing electricity into our homes and industries.  
Raw aluminium from Richards Bay . . . blended into special alloys, heat treated, drawn and woven into mesh fencing . . . fencing that never rusts.



ENQUIRIES  
P.O. BOX 48,  
VEREENIGING, 1930,  
TRANSVAAL, SOUTH AFRICA.  
TELEPHONE: 4-5122.  
TELEX: 6-7826

USCO CABLE COMPANY AND USCO ALUMINIUM CORPORATION  
ARE MEMBER COMPANIES OF UNION STEEL CORPORATION  
(OF SOUTH AFRICA) LIMITED.

# MEMBERSHIP ROLL — LEDELS

## HONORARY MEMBERS — ERELEDE

- ANDERSON, DR. R. B.: Thatchers Field, Lynnwood 0081.  
BARTON, R. W.: P.O. Box 29185, Melville 2109.  
BEESLEY, W.: City Electrical Engineer, P.O. Box 1803, Bulawayo.  
DOWNE, C. G.: 25 Rectory Gardens, Broadwater, Worthing, Sussex, England.  
DOWNEY, J. C.: 10 Jessop Road, Selection Park, Springs 1560.  
EASTMAN, H. A.: "Woodlands Rise," 12 Woodlands Road, Somerset West 7130.  
EWING, R. G.: P.O. Box 779, East London 5200.  
FODEN, A.: 4 Hardy Road, Selborne, East London 5200.  
FRANTZ, A. C. T.: 7 New Way, Pinelands, Cape Town 7405.  
GILES, P. A.: 43 Galloway House, 100 Musgrave Road, Durban 4001.  
HALLE, C. R.: 22 Connaught Road, Pietermaritzburg 3201.  
HUGO, H. J.: Maudstraat 110, Florida 1710.  
LEISHMAN, R.: 66 Tana Road, Emmarentia Extension, Johannesburg 2095.  
LOMBARD, C.: Posbus 4181, Germiston-Suid 1411.  
MIDDLECOTE, A. A.: P/Bag X191, Pretoria 0001.  
MORRISON, J. A.: P.O. Box 792, River Club 2149.  
MULLER, G. J.: Wilcockweg 35, Bloemfontein 9301.  
PLOWDEN, D. C.: 11 Delta Road, Winston Ridge 2196.  
SIBSON, A. R.: P.O. Box 9074, Hillside, Zimbabwe.  
SIMPSON, R. M. O.: 71 Hunters Way, Umgeni Park 4051.  
SMITH, E. L.: 1 Ropley Ross Street, Amantzimoti 4125.  
STEVENS, F.: 9 Apsley Court, 443 Musgrave Road, Durban 4001.  
STRASZACKER, DR. R. L.: 240 Smith Street, Muckleneuk, Pretoria 0002.  
TELLES, J. R.: Maputo, Republica Popular De Mocambique.  
THERON, G. C.: Posbus 12088, Lumier 1905.  
TURNER, H. T.: 33 Heaton Nicholls Road, Kloof 3600.  
VAN DER WALT, J. L.: Posbus 1091, Johannesburg 2000.  
VAN WYK, J. D. N.: Roosstraat 195, Meyerspark 0184.  
WADDY, J. C.: 27 Marshall Road, Athlone, Pietermaritzburg 3201.

## PAST MEMBERS — VOORMALIGE LEDE

- ATTERIDGE, W. H.: P.O. Box 369, Port Elizabeth 6000.  
BARRIE, J. J.: 82 First Avenue, Dunvegan, Edenvale 1610.  
BURTON, C. R.: 54 Memorial Road, Kimberley 8301.  
BOBEK, K. H.: 63 Westville Road, Westville 3630.  
CAMPBELL, A. R.: P.O. Box 3, Impendhele, 4545.  
CLINTON, J. S.: P.O. Box 4648, Johannesburg 2000.  
CONRADIE, D. J. R.: Posbus 1009, Bloemfontein 9300.  
CRONJE, W. J.: Wenningstraat 37, Groenkloof, Pretoria 0181.  
DUNSON, C.: Electricity Supply Commission, P.O. Box 2408, Durban 4000.  
DE VILLIERS, E. E.: Aberdeenweg 69, Clubview 0140.  
DUNSTAN, R. S.: P.O. Box 15024, Emerald Hill, Port Elizabeth 6001.  
ERIKSON, J. G. F.: P.O. Box 24, Margate 4275.  
FORD, W. P.: 16 Abrey Road, Kloof 3600.  
GAMBLE, J. S.: 11 Centenary Road, Clarendon, Pietermaritzburg 3201.  
HARVEY, A. G.: 7j Garden Street, Redhouse, Port Elizabeth 6001.  
HEASMAN, G. G.: P.O. Box 77, Fort Victoria, Zimbabwe.  
HESS, I.: Blackwood, Upper Mountain Road, Somerset West 7130.  
HONNIBALL, G. T.: P.O. Box 17031, Groenkloof 0027.  
LIEBENBERG, S. J.: Posbus 98, Pretoria 0001.  
LYNCH, E. C.: P.O. Box 73, Salisbury, Zimbabwe.  
MAGOWAN, J. M.: S.R. Electricity Supply Commission, P.O. Box 377, Salisbury, Zimbabwe.  
McGIBSON, J.: P.O. Box 164, Carletonville 2500.  
MOLE, E. W.: P.O. Box 39663, Bramley 2018.  
McWILLIAM, E. A.: 202 Nicholson Street, Brooklyn, Pretoria 0181.  
MULLER, H. M. S.: 1 Nesor Street, Graaff-Reinet 6280.  
POTGIETER, N. A.: Webbstraat 1211, Queenswood, Pretoria 0186.  
POTTA, K. U.: Malherbestraat 9, Uppington 8800.  
REICHERT, W. J.: P/a Universiteitsingenieur, Universiteit van Kaapstad, Privaatzaak, Rondebosch 7700.  
ROSSLER, A.: 3 Greenwood Road, Pietermaritzburg 3201.  
RUSH, W.: 29 Fouché Street, Dundee 3000.  
WILLIAMS, J. T.: P.O. Box 1617, Pretoria 0001.  
WYLIE, R. J. S.: P.O. Box 217, Germiston 1400.

## ENGINEER MEMBERS — INGENIEURSLEDE

### A

- ADAMS, C. E.: City Electrical Engineer, P.O. Box 369, Port Elizabeth 6000.  
ALGERA, J. D.: Elektrotegniese Stadsingenieur, Posbus 16, Rustenburg 0300.

### B

- BAILEY, R. V.: Borough & Electrical Engineer, P.O. Box 72, Stanger 4450.  
BAKER, A. B.: Electrical Engineer, P.O. Box 20, Swellendam 6740.  
BARNARD, W.: City Electrical Engineer, P.O. Box 699, Johannesburg 2000.  
BEARD, G. R.: Town Electrical Engineer, P.O. Box 176, Grahamstown 6140.  
BEKKER, M. J.: Elektrotegniese Ingenieur, Posbus 96, Louis Trichardt 0920.  
BLEACH, R. L.: Town Electrical Engineer, Empangeni 3880.  
BOOSENS, L.: Elektrotegniese Ingenieur, Posbus 155, Vrede 2455.  
BOSHOFF, J. J.: Elektrotegniese Stadsingenieur, Posbus 3, Vanderbijlpark 1900.  
BOTES, P. J.: Elektrotegniese Ingenieur, Posbus 217, Rooodepoort 1725.  
BOTH, A.: Hoof, Elektriese Afdeling, Posbus 6, Delmas 2210.  
BOTH, J. J.: P.O. Box 708, Welkom 9460.  
BOTH, N. S.: Town Electrical Engineer, P.O. Box 288, Bloemfontein 9300.  
BOTH, P. J.: Posbus 37, Viljoenskroon 9520.  
BOTH, A.: Posbus 6, Delmas 2210.  
BOTHMA, O.: Town Electrical Engineer, P.O. Box 52, Robertson 6705.  
BOYACK, I. F.: City Electrical Engineer, P.O. Box 423, Pretoria 0001.  
BOZYCZKO, W.: P.O. Box 15, Estcourt 3310.  
BRIERS, D. B.: Elektrotegniese Ingenieur, Posbus 302, Kroonstad 9500.  
BRINK, P. S. J.: Town Electrical Engineer, P.O. Box 20, Hermanus 7200.  
BRUMMER, J. G.: Elektrotegniese Ingenieur, Posbus 17, Stellenbosch 7600.

### C

- CARMICHAEL, T. R.: Borough Electrical-Mechanical Engineer, P.O. Box 72, Stanger 4450.  
CLARE, C. A.: Borough Electrical Engineer, P.O. Box 5, Howick 3290.  
CLARKE, M. M. P.: City Electrical Engineer, P/Bag 1, Randburg 2125.  
CLAXTON, H. D.: Electrical Engineer, P.O. Box 71, Graaff-Reinet 6280.  
CLOETE, J.: Chief Electrical Engineer, P.O. Box 44, Ceres 6835.  
CLOETE, D. J.: Posbus 99, Klarksdorp 2570.  
CLOETE, R. H.: Dorpsingenieur, Posbus 20, Senekal 9600.  
COOPER-CHADWICK, C.: P.O. Box 57, Germiston 1400.  
CRONJE, G. P.: Hoof Tegniese Beampte, Posbus 36, Duiwelskloof 0835.

### D

- DAVIES, E. G.: City Electrical Engineer, P.O. Box 399, Pietermaritzburg 3200.  
DAUTH, W. J.: Chief Electrical Engineer, P.O. Box 48, Volksrust 2470.  
DAWSON, J. D.: Municipal Electrical Engineer, P.O. Box 45, Uitenhage 6230.  
DE BRUIN, H. J.: Elektrotegniese Stadsingenieur, Posbus 218, Randfontein 1760.  
DE BRUYN, C. D.: Elektrotegniese Ingenieur, Posbus 10, Camarvon 7060.  
DE KOCK, F. P.: Posbus 156, Virginia 9430.  
DELPOR, J. L. F. H.: Adjunk-Elektroniese Stadsingenieur, Posbus 25, Edenvale 1610.  
DEKENAH, K. C.: Town & Electrical Engineer, P.O. Box 33, Barberton 1300.  
DERNIER, W.: Electrical Engineer, P.O. Box 206, Aliwal North 5530.  
DREYER, L.: Elektrotegniese Ingenieur, Posbus 19, Westonaria 1780.

DU PLESSIS, G. P.: Elektrotegniese Ingenieur, Posbus 37, Worcester 6850.  
DU TOIT, E.: Elektrotegniese Stadsingenieur, Posbus 16, Brits 0250.  
DU TOIT, P. L.: Posbus 34, Orkney 2620.  
DU TOIT, A. J.: Elektrotegniese Ingenieur, Posbus 37, Viljoenskroon 9520.  
DU TOIT, E.: Elektrotegniese Ingenieur, Posbus 52, Robertson 6705.  
DE WET FOURIE, ??: Posbus 155, Kinross 2270.  
DE WET, L. D. M.: Stads-Elektrotegniese Ingenieur, Posbus 15, Brakapan 1540.

#### E

EHRICH, J. A.: Town Electrical Engineer, P.O. Box 66, Standerton 2430.  
ERASMUS, P. R.: Adjunk Elektrotegniese Stadsingenieur, Posbus 2, Secunda 2302.

#### F

FLETCHER, J. L.: Deputy City Electrical Engineer, P.O. Box 147, Durban 4000.  
FORTMANN, A. H. L.: Town Electrical Engineer, P.O. Box 215, Boksburg 1460.  
FRASER, D. H.: City Electrical Engineer, P.O. Box 147, Durban 4000.  
FRENCH, E. M.: Borough Engineer, P.O. Box 71, Greytown 3500.  
FUTCHER, L.: Municipal Electrical Engineer, P.O. Box 13, Kempton Park 1620.

#### G

GOUSSARD, P. J.: Hoofelektroisier, Posbus 14, Koppies 9540.  
GOWIE, E.: Electrical Foreman, P.O. Box 35, Matatiele, East Griqualand 4730.  
GROBLER, J.: Elektrotegniese Stadsingenieur, Posbus 551, Bethlehem 9700.  
GROVE, G. R.: Hoofelektroisier, Posbus 43, Harrismith 9880.  
GREYLING, A. J.: Senior Tegnieise Beampte, Privaatsak X2016, Standerton 2430.  
GROTIUS, R. J.: Posbus 13, Dewetsdorp 9940.

#### H

HAIG-SMITH, D.: Town Electrical Engineer, P.O. Box 113, Queenstown 5320.  
HALLIDAY, K. W. J.: Municipal Electrical Engineer, P.O. Box 5, Port Shepstone 4240.  
HAMMERSCHLAG, S. N.: Town Electrical Engineer, P.O. Box 3, Bedfordview 2008.  
HARPESTAD, P.: P.O. Box 21, Knysna 6570.  
HEYDENRYCH, J. E.: Elektrotegniese Ingenieur, Posbus 14, Middelburg 1050.  
HUGO, A. H. W.: Town Electrical Engineer, P.O. Box 78001, Sandton 2146.  
HUGO, J. G.: Electrical Engineer, P.O. Box 51, Bredasdorp 7280.  
HUNT, L. E.: Town-Electrical Engineer, P.O. Box 2, White River 1240.

#### J

JANTZEN, G. H.: Elektrotegniese Stadsingenieur, Posbus 29, Henneman 9445.  
JANSE VAN RENSBURG, W. W.: Posbus 14064, Benoni 1500.  
JELLMAN, C. E.: P.O. Box 38, Fort Beaufort 5720.  
JORDAAN, D. J. P.: Posbus 48, Ermelo 2350.  
JORDAAN, P. W.: Hoof Elektrotegniese Afdeling, Posbus 34, Potgietersrus 0600.

#### K

KOBUS, E. E.: Posbus 206, Aliwal-Noord 5530.  
KOK, J. A.: Waarn, Elektrotegniese Ingenieur, Posbus 55, Middelburg 5900.  
KREBS, W. F.: Privaatsak 2209, Otiwaworongo 9210.  
KRUGER, M. J. C.: Elektrotegniese Ingenieur, Posbus 13, Port Alfred 6170.

#### L

LAAS, C. P.: Elektrotegniese Ingenieur, Posbus 15, Kenhardt 8900.  
LABUSCHAGNE, J. J.: Elektrotegniese Stadsingenieur, Posbus 86, Walvisbaai 9190.  
LE ROUX, D. F.: Elektrotegniese Ingenieur, Posbus 36, Duiwelskloof 0835.  
LEWIS, L.: Town Electrical Engineer, P.O. Box 59, Windhoek 9100.  
LIEBENBERG, H. D. G.: Snr. Tegnieise Assistent (Elektries en Werkwinkel), Posbus 64, Ladybrand 9745.  
LOCHNER, J. van S.: Elektrotegniese Ingenieur, Posbus 111, Pietersburg 0700.  
LOTTER, G. A.: Elektrotegniese Ingenieur, Posbus 34, Potgietersrus 0600.  
LOUBSER, J. A.: Elektrotegniese Ingenieur, Posbus 1014, Benoni 1500.  
LOUW, H. A. L.: Elektrotegniese Stadsingenieur, Posbus 12, Paarl 7620.

#### M

MALAN, J. G.: Elektrotegniese en Meganiese Ingenieur, Posbus 13, Kempton Park 1620.  
MARAI, C. H. A.: Stads-Elektroisier Meganiese Ingenieur, Posbus 359, Parys 9585.  
McMILLAN, K. H. D.: Electrical Engineer, P.O. Box 47, Umata 5100.  
McNAMARA, A. B.: Electrical Engineer, P.O. Box 21, Komga 4950.  
MILLEN, T. J.: Town & Electrical Engineer, P.O. Box 24, Tzaneen 0850.  
MOSTERT, S. A.: Elektrotegniese Ingenieur, Posbus 19, George 6530.  
MOSTERT, A. H.: Posbus 53, Swakopmund 9180.  
MULDER, J. A. C.: Posbus 60, Piketberg 7320.  
MURPHY, K. J.: Municipal Electrical Engineer, P.O. Box 19, Somerset West 7130.  
MYBURGH, G.: Elektrotegniese Ingenieur, Posbus 4, Kuruman 8460.

#### N

NEL, J. T. F.: Elektrotegniese Stadsingenieur, Posbus 33, King Williamstown 5600.  
NORTJE, G. J.: Elektrotegniese Stadsingenieur, Posbups 145, Germiston 1400.

#### O

ODENDAAL, M. W.: Elektrotegniese Stadsingenieur, Posbus 4, Alberton 1450.

#### P

PAGEL, P. V. E.: Elektrotegniese Ingenieur, Munisipaliteit, Pieltzenbergbaai 6600.  
PALSER, D. C.: City Electrical Engineer, P.O. Box 82, Cape Town 8000.  
PEENS, J. G.: Dorpsingenieur, Posbus 24, Carolina 1185.  
PETERS, A. G.: Town Electrical Engineer, P.O. Box 278, Gwelo, Zimbabwe.  
PIENAAR, J. F.: Dorps- en Elektrotegniese Ingenieur, Posbus 26, Winburg 9420.  
PIKE, E. B.:  
PIVA, J. H.: Principal Engineer, Amatola Row No. 73, King Williamstown 5600.  
POTGIETER, D. E. T.: Elektrotegniese Stadsingenieur, Posbus 14103, Verwoerdburg 0140.  
PRETORIUS, E. de C.: Elektrotegniese Stadsingenieur, Posbus 113, Potchefstroom 2520.  
PRETORIUS, J. W.: Assistent-Elektrotegniese Ingenieur, Posbus 23, Nigel 1490.  
PRETORIUS, P. J. R.: Elektrotegniese Stadsingenieur, Posbus 35, Vryburg 8600.  
PRITCHARD, M. R.: Elektrotegniese Stadsingenieur, Privaatsak X7, Virginia 9430.  
PURDON, D.: Town Electrical Engineer, P.O. Box 67, Phalaborwa 1390.

#### R

RATTEY, W. P.: Electrical Engineer, P.O. Box 3, Strand 7140.  
ROBSON, K. G.: City Electrical Engineer, P.O. Box 529, East London 5200.  
ROODT, J. S. G.: Posbus 26, Reitz 9810.

- S**
- SCHREUDER, T. P.: Posbus 98, Vredendal 8160.  
 SMALL, C. T. R.: Town Electrical Engineer, P.O. Box 9, Beaufort West 6970.  
 SMITH, F. H.: Electrical Engineer, P.O. Box 42, Despatch 6220.  
 STAPLETON, R.: Borough Electrical Engineer, P.O. Box 37, Eshoew 3815.  
 STRAUSS, J. C.: Elektrotegniese Ingenieur, Posbus 60, Sasolburg 9570.  
 SWART, T. L.: Elektrotegniese Ingenieur, Posbus 10, Glencoe 2930.  
 SWART, F. C.: Groenewaldstraat 49, Petrus Steyn 9640.

- T**
- TE BRUGGE, E. J.: Electrical Engineer, P.O. Box 42, Mafikeng 8670.  
 TEN GATE, J.: Elektrotegniese Ingenieur, Posbus 7, Lichtenburg 2740.  
 TRAUTMANN, E. P. E. W.: Electrical Engineer, P.O. Box 29, Ladysmith 3370.  
 TURNBULL, A. F.: Town Electrical Engineer, P.O. Box 35, Vereeniging 1930.

- V**
- VAN DER MERWE, P. J.: Stads-Elektrotegniese Ingenieur, Posbus 20, Stillfontein, 2550.  
 VAN DER MERWE, G.: Posbus 96, Louis Trichardt 0920.  
 VAN DER MERWE, D. S.: Elektrotegniese Ingenieur, Posbus 3, Witbank 1035.  
 VAN DER MERWE, F. J.: Elektrotegniese Ingenieur, Posbus 3, Carleedelberg 2400.  
 VAN DER SCHYFF, G. W.: Stadsingenieur, Posbus 3, Bethal 2031.  
 VAN DEN BERG, A. J.: Elektrotegniese Ingenieur, Posbus 94, Krugersdorp 1740.  
 VAN DER WALT, F. S. P.: Privaatsak 5005, Kimberley 8300.  
 VAN HEERDEN, W. J. B.: Elektrotegniese Ingenieur, Posbus 201, Heidelberg 2400.  
 VAN MEERDERSVORT, J. K. L.: Elektrotegniese Ingenieur, Posbus 33, Barberton 1300.  
 VAN NIEKERK, P. J. S.: Borough Electrical Engineer, P.O. Box 21, Newcastle 2940.  
 VAN ROOYEN, H. E.: Dorps. Waterwerke en Elektrotegniese Ingenieur, Munisipaliteit, Kirkwood 6120.  
 VAN TONDER, C. J.: Elektrotegniese en Werktuigkundige Ingenieur, Posbus 21, Odendaalsrus 9480.  
 VAN WYK, A. A.: Elektrotegniese Ingenieur, Posbus 45, Nelspruit 1200.  
 VENTER, J. A.: P.O. Box 82, Cape Town 8000.  
 VENTER, J. L.: Posbus 31, Wepener 9944.  
 VENTER, G. A.: Elektrotegniese Ingenieur, Posbus 9, Meyerton 1960.  
 VELDSMAN, D. E.: Elektrotegniese Ingenieur, Posbus 17, Vredenburg 7380.  
 VIDLER, J. A.: P.O. Box 21, Jeffreys Bay 6330.  
 VON AHLFTEN, J. K.: Elektrotegniese Ingenieur, Posbus 45, Springs 1560.  
 VOSLOO, C.: Posbus 628, Kimberley 8300.

- W**
- WEAKLEY, S. L.: P.O. Box 24, Cradock 5880.  
 WHEELER, D. J.: Posbus 13, Burgersdorp 5520.  
 WRIGLEY, P.: City Electrical Engineer, P.O. Box 73, Salisbury, Zimbabwe.

#### ASSOCIATE MEMBERS — ASSOSIAATLEDE

- B**
- BECK, H. D.: Deputy City Electrical Engineer, P.O. Box 529, East London 5200.  
 BRINK, H. J.: Groepingenieur, Posbus 288, Bloemfontein 9300.

- C**
- CARTER, C. T.: Assistant City Electrical Engineer, P.O. Box 82, Cape Town 8000.

- D**
- DE VILLIERS, A. S.: Mechanical-Electrical Engineer, 3 Utrecht St., Monte Vista 7460.  
 DE VRIES, G. S.: Groepingenieur-Verspreiding, Posbus 1079, Bloemfontein 9300.  
 DE BEER, W. H.: Adjunk-Elektroniese Stadsingenieur, Posbus 48, Warmbad 0480.  
 DELPORT, J. L. F. H.: Adjunk-Elektroniese Stadsingenieur, Posbus 25, Edenvale 1610.  
 DU PLESSIS, C. J.: Posbus 868, Kempton Park, 1620.  
 DU PLESSIS, G. C.: Adjunk-Elektrotegniese Stadsingenieur, Posbus 94, Krugersdorp 1740.  
 DU TOIT, R. E.: Posbus 2694, Witbank 1035.

- H**
- HILL, D. R.: City Electricity Department, P.O. Box 147, Durban 4000.  
 HOBBS, J. L.: Deputy Electrical Engineer, P.O. Box 45, Uitenhage 6230.

- L**
- LAMPRECHT, B. C.: Privaatsak X014, Benoni 1500.  
 LEIGH, R. A.: Deputy City Electrical Engineer, P.O. Box 699, Johannesburg 2000.

- M**
- McINTYRE, H. A.: Town Electrical Engineer, P.O. Box 35, Vereeniging 1930.

- O**
- OPPERMAN, D. J.: Elektrotegniese Ingenieur, Posbus 45, Springs 1560.

- P**
- POLLOCK, T.: Electrical Engineer, P.O. Box 3, Gordon's Bay 7150.

- R**
- RAUTENBACH, G. F.: Elektrotegniese Ingenieur, Posbus 99, Klerksdorp 2570.  
 RHEEDER, R. J. B.: Posbus 41, Cathcart 5310.

- S**
- SCHOLLES, E. H.: Deputy City Electrical Engineer, P.O. Box 699, Johannesburg 2000.  
 SMITH, A. M.: Assistant City Electrical Engineer (Distribution), P.O. Box 369, Port Elizabeth 6000.  
 SURTHEES, E. H.: Deputy Town Engineer, P.O. Box 215, Boksburg 1460.

- V**
- VAN DER WALT, C. J.: Privaatsak X014, Benoni 1500.  
 VAN SCHALKWYK, A. P.: Assistent-Elektrotegniese Stadsingenieur, Posbus 288, Bloemfontein 9300.

#### LOCAL AUTHORITIES — PLAASLIKE BESTURE

- A**
- Adelaide, CP.  
 Administrasieraad, Hoëveldgebied.  
 Administrasieraad, Noord-Kaap.  
 Administrasieraad, Oos-Rand.  
 Administrasieraad, Oranje-Vaal.  
 Administrasieraad, Sentraal Transvaal.  
 Administrasieraad, Wes-Rand.  
 Alberton, Tvl.  
 Alwal Noord, KP.

- B**
- Barberton, Tvl.  
 Benoni, Tvl.  
 Bethlehem, OVS.  
 Bloemfontein, OVS.

Brakpan, Tvl.  
Burgersdorp, KP.  
Beaufort-Wes, KP.  
Bethal, Tvl.  
Boksburg, Tvl.  
Bredasdorp, KP.  
Bedfordview Village Council, Tvl.  
Bothaville, OVS.  
Brits, Tvl.  
Brandfort, OVS.

#### C

Cape Town.  
Carolina, Tvl.  
Carletonville, Tvl.  
Cathcart.  
Ceres, KP.  
Carnarvon, KP.  
Cradock, KP.

#### D

De Aar, KP.  
Despatch.  
Duiwelskloof, Tvl.  
Delmas, Tvl.  
Dundee, Natal.  
Dewetsdorp, OVS.  
Durban.

#### E

East London, CP.  
Ermelo, Tvl.  
Evander, Tvl.  
Edenvale, Tvl.  
Eshowe, Natal.  
Empangeni, Natal.  
Estcourt, Natal.

#### F

Fochville, Tvl.  
Fort Beaufort, CP.

#### G

George, CP.  
Gobabis, SWA.  
Grahamstown, CP.  
Germiston, Tvu.  
Gordons Bay, CP.  
Greytown, Natal.  
Glencoe, Natal.  
Graaff-Reinet, CP.

#### H

Heidelberg, Tvl.  
Henneman, OVS.  
Hermanus, CP.  
Howick, Natal.

#### J

Johannesburg.  
Jeffreysbaai, KP.

#### K

Kakamas, KP.  
Kenhardt, KP.  
Kirkwood, KP.  
Kokstad, Oos-Griekwaland.  
Kroonstad, OVS.  
Keetmanshoop, SWA.  
Kimberley, KP.  
Klerksdorp, Tvl.  
Komgha, CP.  
Krugersdorp, Tvl.  
Kempston Park, Tvl.  
King Williamstown, CP.  
Knysna, KP.  
Koppies, OVS.  
Kuruman, KP.

#### L

Ladybrand, OVS.  
Ladysmith, Natal.  
Lydenburg, Tvl.  
Lichtenburg, Tvl.

#### M

Matikeng.  
Meyerton, Tvl.  
Mooi River, Natal.  
Matatiele, Oos-Griekwaland.  
Middelburg, Tvl.  
Mosselbaai, KP.  
Middelburg, KP.

#### N

Nelspruit, Tvl.  
Newcastle, Natal.  
Nigel, Tvl.

#### O

Odendaalsrus, OVS.  
Orkney, Tvl.  
Otjiwarongo, SWA.  
Oudtshoorn.

#### P

Paarl, KP.  
Pietermaritzburg, Natal.  
Plettenbergbaai, KP.  
Port Shepstone, Natal.  
Potgietersrus, Tvl.  
Peri-Urban Areas Health Board, Pretoria.  
Parys, OVS.  
Pletersburg, Tvl.  
Port Alfred, CP.  
Postmasburg, KP.  
Pretoria, Tvl.  
Phalaborwa, Tvl.  
Piet Retief, Tvl.  
Picketberg.  
Port Elizabeth, CP.  
Potchefstroom, Tvl.  
Petrus Steyn.

#### Q

Queenstown, CP.

#### R

Randburg.  
Randfontein, Tvl.  
Robertson, CP.  
Richardsbaai, Natal.  
Roodepoort, Tvl.  
Riversdale, CP.  
Rustenburg, Tvl.

#### S

Sandton, Tvl.  
Secunda.  
Somerset West, CP.  
Stanger, Natal.  
Strand, KP.  
Sasolburg.  
Senekal, OVS.  
Springs, Tvl.  
Stellenbosch, KP.  
Swakopmund, SWA.  
Somerset East, CP.  
Standerton, Tvl.  
Swellendam.  
Stilfontein.

#### T

The Divisional Council of the Cape.  
Tarkastad, KP.  
Thabazimbi, Tvl.  
Tzaneen, Tvl.  
Tongaast, Natal.

**U**

Uitenhage, CP.  
Umtata, Transkei.  
Uppington, CP.

**V**

Vanderbijlpark, Tvl.  
Viljoenskroon, OVS.  
Vredenburg-Saldanha, CP.  
Vereeniging, Tvl.  
Virginia, OVS.  
Vrede, OVS.  
Vryburg, KP.  
Verwoerdburg, Tvl.  
Volksrust, Tvl.  
Vryheid, Natal.  
Vredendal.

**W**

Walvis Bay, SWA.  
Wellington, KP.  
Wepener, OVS.  
Westonaria, Tvl.  
Witbank, Tvl.  
Worcester, KP.  
Warmbad, Tvl.  
Winburg, OVS.  
Witriver, Tvl.  
Welkom, OVS.  
Windhoek, SWA.  
Wolmaransstad, Tvl.

**AFFILIATE MEMBERS/GEAFFILIEERDE LEDE****A**

AECI Ltd.: P.O. Box 1122, Johannesburg, 2000. Tel. 975-8111.  
AEG Telefunken (Pty) Ltd.: P.O. Box 10264, Johannesburg, 2000.  
Tel. 786-3400.  
Ash Brothers (Pty) Ltd.: P.O. Box 6061, Johannesburg, 2000.  
Tel. 834-3751.  
ATW Electrical (Pty) Ltd.: P.O. Box 2873, Johannesburg, 2000.  
Tel. 836-0501.  
Aberdare Cables Africa Ltd.: P.O. Box 494, Port Elizabeth, 6000.  
Tel. 45331.  
African Cables Ltd.: P.O. Box 172, Vereniging, 1930.  
Tel. (016) 4-5821.  
Allied Electric (Pty) Ltd.: P.O. Box 6090, Dunswart, 1508.  
Tel. ??????  
Alusaf: P.O. Box 284, Empangeni, 3880. Tel. 5-1111, Richards Bay.  
Anode Electrical Engineering & Construction Co.: P.O. Box 873,  
Brakpan, 1540. Tel. 55-8370.  
Asea Electric (Pty) Ltd.: P.O. Box 691, Pretoria, 0001.  
Tel. 79-7020.  
Aycliffe Cables Ltd.: P.O. Box 1558, Edenvale, 1610. Tel. 609-4020.  
Avon Wire (Pty) Ltd.: P.O. Box 162, Randfontein, 1760.  
Tel. 663-3645.

**B**

Ballenden & Robb: P.O. Box 4648, Johannesburg, 2000.  
Tel. 29-1811.  
Beka Engineering Co. (Pty) Ltd.: P.O. Box 50392, Wierda Park,  
0149. Tel. (012) 6444708.  
Bosal Afrika (Pty) Ltd.: P.O. Box 1652, Pretoria, 0001.  
Tel. (012) 731171.  
Bowthorpe-Hellerman-Deutsch (Pty) Ltd.: P.O. Box 27063,  
Benrose, 2011. Tel. 614-1111.  
Brian Colquhoun, O'Donnell & Pines (Pty) Ltd.: P.O. Box 31757,  
Braamfontein, 2017. Tel. 39-4376.  
Brown Boveri Orsal (Pty): P.O. Box 10968, Johannesburg, 2000.  
Tel. 618-2700.  
Brown Boveri SA (Pty) Ltd.: P.O. Box 1500, Johannesburg, 2000.  
Tel. 836-5791.

**C**

Charles Elvey Agencies (Pty) Ltd.: P.O. Box 8082,  
Johannesburg, 2000. Tel. 614-6541.  
Cani Gartenbach, Vorster & De Vries, Posbus 1079, Bloemfontein  
9300. Tel. 78081.  
Chemilite Engineering (Pty) Ltd.: P.O. Box 25720, Denver, 2027.  
Tel. 616-1313.  
Clinkscalles Maughan Brown & Ptns., P.O. Box 196, Port  
Elizabeth, 6000. Tel. (041) 29731.  
Clinkscalles Maughan Brown & Ptns., P.O. Box 570, Cape Town,  
8000.  
Complete Cabling Equipment (Pty) Ltd.: P.O. Box 107, Mondeor,  
2110. Tel. 830-7029.  
Conradie D. J. J. & Vennote, Posbus 17031, Groenkloof, 0001.  
Tel. 3-1755.  
Crompton Parkinson SA (Pty) Ltd.: P.O. Box 4236, Johannesburg  
2000. Tel. 680-3400.  
Cu Ai Engineering (Pty) Ltd.: P.O. Box 18228, Dalbridge, 4014,  
Natal. Tel. (031) 210285.  
Cutler-Hammer (SA) Ltd.: P.O. Box 14089, Wadeville, 1422.  
Tel. 34-9124.  
Crabtree J. A. (Pty) Ltd.: P.O. Box 413, Springs, 1560.  
Tel. 56-7911.

**D**

De Villiers & Moore, Posbus 472, Durbanville, 7750. Tel. 96-3087.  
Drewett, Hubble & Pokorny, P.O. Box 7034, Johannesburg, 2000.  
Tel. 788-5460.  
Du Toit C. A. & Partners: P.O. Box 4256, Pretoria, 0001.  
Tel. 3-8591.  
Du Toit C. A. & Vennote (Suid): Posbus 4263, Kaapstad, 8012.  
Tel. 25-541.  
Duropernia (Tvl.) (Pty) Ltd.: P.O. Box 389, Germiston, 1400.  
Tel. 34-9241.

**E**

Eberhardt-Martin (Pty) Ltd.: P.O. Box 85027, Emmarentia, 2029.  
Tel. 46-2176.  
Egalube Plastic Conduits (Pty) Ltd.: P.O. Box 140, Rosslyn,  
Pretoria, 0001. Tel. 58-2238.  
Electric Centre (Pty) Ltd.: P.O. Box 291, Maitland, 7405.  
Tel. 51-8230.  
Electrical Contractor Asso. of SA: P.O. Box 33367, Jeppestown,  
2043. Tel. 618-1060.  
Electrical Protection Co. (Pty) Ltd.: P.O. Box 1034, Boksburg,  
1400. Tel. 52-7871.  
Emag Electrical Engineering (Pty) Ltd.: P.O. Box 27129,  
Benrose, 2011. Tel. 680-8263.  
Everitt, Germishuizen & Vennote, Posbus 4083, Johannesburg,  
2000. Tel. 22-2541.  
Elco Agencies: P.O. Box 22139, Glenashley, 4022. Tel. 52-5677.

**F**

Fulmen Africa (Pty) Ltd.: P.O. Box 8023, Elandsfontein, 1406.  
Tel. 36-5201.  
Farad (Pty) Ltd.: P.O. Box 31220, Braamfontein, 2017.  
Tel. 41-4446.  
Fuchs Electrical Ind. (Pty) Ltd.: P.O. Box 3758, Alrode, 1451.  
Fuji Appliances SA (Pty) Ltd.: P.O. Box 553, Pinetown, 3600.  
Tel. (031) 71-4114.  
Fainsinger G. S. Associates: P.O. Box 2142, Windhoek, 9100.  
Tel. ??????  
Fluke (SA) Ltd.: P.O. Box 38797, Bramley, 2018. Tel. 786-3170.  
Fluidex Engineering: P.O. Box 109, Chloorkop 1624.  
Tel. 609-5350/1/2.

**G**

Gardner, D. A. Consulting Engineers: 278 Oxford Street, East  
London, 5201. Tel. 23690.  
GEC Power Distribution Ltd.: P.O. Box 13024, Knights, 1413.  
Tel. 826-6547.  
GEC Lighting: P.O. Box 25696, Denver, 2027. Tel. 615-6530.  
GEC Measurements SA (Pty) Ltd.: P.O. Box 23024, Knights 1413.  
Tel. (011) 826-6647.  
GEC Power Projects Co.: P.O. Box 13024, Knights 1413.  
Tel. (011) 826-6647.  
GEC Cables Co.: P.O. Box 13024, Knights 1413.  
Tel. (011) 826-6647.  
Gohnix (Pty) Ltd.: P.O. Box 2512, Cape Town, 8000.  
Tel. (021) 952165.

**H**

Hawker-Siddeley Africa Switchgear (Pty) Ltd.: P.O. Box 417,  
Roodepoort 1725. Tel. 764-2566.  
Hawker-Siddeley Africa Transformers (Pty) Ltd., P.O. Box 9159,  
Elsburg, 1407. Tel. 34-5428.  
H. D. Symons Manufacturing (Pty) Ltd.: P.O. Box 63, Roodepoort,  
1725. Tel. 763-5457.  
Hsineman Electric SA Ltd.: P.O. Box 881, Johannesburg, 2000.  
Tel. 36-7033.  
Hill, Kaplan, Scott & Ptns.: P.O. Box 17321, Hillbrow, 2038.  
Tel. 842-4791.  
Huletts Aluminium Ltd.: P.O. Box 25, Olifantsfontein, 1665.  
Tel. 61-2201.  
Hubert Davies Electrical Eng. (Pty) Ltd.: P.O. Box 8077,  
Elandsfontein, 1403. Tel. 36-2511.  
Holley Bros. (Pty) Ltd.: P.O. Box 1699, Pietermaritzburg, 3200.  
Tel. 51-531.



**I**  
Interswitch (Pty) Ltd.: P.O. Box 11048, Johannesburg, 2000.  
Tel. 678-1193.

**J**  
Jackson A. P.O. Box 4814, Cape Town, 8000.

**K**  
Ken Shepstone & Ptns.: 3rd Floor, Fassifern, 35 Ridge Rd., Durban, 4001. Tel. (031) 292261.  
Kitpatrick SA (Pty) Ltd.: P.O. Box 6869, Johannesburg, 2000.  
Tel. 29-2841.  
Klockner-Moeller (SA) (Pty) Ltd.: P.O. Box 100, Kempton Park, 1975-3937.  
Kwika Limited: P.O. Box 389, Benoni, 1500. Tel. 892-1062.

**L**  
Lascon Lighting Industries (Pty) Ltd.: P.O. Box 7125, Johannesburg, 2000. Tel. 839-2341.  
Litecor Electrical Distributors, P.O. Box 33424, Jeppestown, 2043. Tel. 614-6011.  
Litemaster Products Ltd.: P.O. Box 6973, Johannesburg, 2000.  
Tel. 22-7544  
Lumex (Pty) Ltd.: P.O. Box 39045, Bramley 2018. Tel. 786-5122.

**M**  
Marais, G. H. & Vennote: Posbus 1789, Pretoria 0001.  
Tel. (012) 3-1651.  
Marthinussen & Coultis: P.O. Box 40018, Cleveland 2022.  
Tel. 25-8167.  
Marthinussen, L. H. Limited: P.O. Box 25664, Denver 2027.  
Tel. 25-8961.  
Meissner, H. G. & Co. (Pty) Ltd.: P.O. Box 10667, Johannesburg 2000. Tel. 838-4714.  
Merz & McLellan: P.O. Box 31012, Braamfontein 2017.  
Tel. 39-5754.  
Midland Equipment (Pty) Ltd.: P.O. Box 440, Kempton Park 1620.  
Tel. 975-5941.  
Tel. (031) 251536.  
Truvelo Manufacturers (Pty) Ltd.: P.O. Box 14183, Verwoerdburg 0140.  
M. K. Electrical (Pty) Ltd.: P.O. Box 140, Rosslyn, 0200.  
Tel. (012) 58-2238.

**N**  
North & Robertson (Pty) Ltd.: P.O. Box 309, East London, 5200.  
Tel. 23-387.  
NKF Groep: P.O. Box 8514, Johannesburg, 2000. Tel. 53-1318.  
Nordland (Pty) Ltd.: P.O. Box 23052, Joubert Park 2044.  
Tel. 724-0384/5/6.

**O**  
Oak Industries (SA) (Pty) Ltd.: P.O. Box 1172, Pietermaritzburg, 3200. Tel. (0331) 51311.  
Ogafin (Pty) Ltd.: P.O. Box 514, Roodspoor, 1725. Tel. 21-7758.  
Ove Arup & Partners Consulting Engineers: P.O. Box 52285, Saxonwold, 2132. Tel. 42-6624.

**P**  
Photosware (Pty) Ltd.: P.O. Box 391, Springs, 1560. Tel. 818-5811.  
Pirelli General Cables (SA) (Pty) Ltd.: P.O. Box 605, Florida, 1700. Tel. 674-2040.  
Preformed Line Products: P.O. Box 958, Pietermaritzburg, 3200.  
Tel. (0331) 71520.  
Process Control Instrumentation (Pty) Ltd.: P.O. Box 5912, Johannesburg, 2000. Tel. 674-1334.  
Power Engineers (Pty) Ltd.: P.O. Box 44, Eppindust, 7475.  
Tel. (021) 54-2681.  
Power Lines (Pty) Ltd.: P.O. Box 1989, Johannesburg, 2000.  
Tel. 752-5350.  
Power Contractors (Pty) Ltd.: P.O. Box 9236, Johannesburg, 2000. Tel. 683-3330.

**R**  
Raychem (Pty) Ltd.: P.O. Box 134, Olifantsfontein, 1665.  
Tel. 61-1628  
Republic of South Africa Communication Co. (Pty) Ltd.: P.O. Box 418, Bergville, 2012. Tel. 786-5010.  
Reunert & Lentz Ltd.: P.O. Box 92, Johannesburg, 2000.  
Tel. 636-1351.

Roy, G. & Co. Ltd.: P.O. Box 1975, Salisbury, Zimbabwe.  
Reyrolle Parsons of SA (Pty) Ltd.: P.O. Box 8080, Elandsfontein, 1406. Tel. 36-2866.  
Rogers G. S. (Pty) Ltd.: P.O. Box 27169, Benrose, 2011.  
Tel. 24-8134.  
RHP Bearings SA (Pty) Ltd.: P.O. Box 318, Isando, 1600.  
Tel. 25-3161.

**S**  
SA National Committee on Illumination, P.O. Box 395, Pretoria, 0001. i.e.l. 73 7010.  
Scottish Cables SA Ltd.: P.O. Box 2882, Johannesburg, 2000.  
Tel. 613-5845.  
Scottish Cables SA Ltd.: P.O. Box 188, Pietermaritzburg, 3200.  
Tel. (0331) 61331.  
Siemens SA (Pty) Ltd.: P.O. Box 4583, Johannesburg, 2000.  
Tel. 715-9111.  
Sigmaturn SA (Pty) Ltd.: P.O. Box 51319, Randburg, 2125.  
Tel. 793-1324.  
SA General Electric Co. (Pty) Ltd.: P.O. Box 5032, Benoni South, 1500. Tel. 52-8111.  
Sentracorn Ltd.: P.O. Box 61204, Marshalltown, 2107.  
Tel. 636-6911.  
Simplex-GE Lighting (Pty) Ltd.: P.O. Box 6168, Marshalltown, 2107. Tel. 638-7921.  
Stiöbel Eitron (Pty) Ltd.: 189 D. F. Malan Drive, Northcliff, 2195.  
Tel. 46-2041.  
Stone Platt Electrical (Stamcor) (Pty) Ltd.: P.O. Box 50292, Randburg, 2125. Tel. 48-1150.  
Sulzer Bros. SA Ltd.: P.O. Box 930, Johannesburg, 2000.  
Tel. 37-4170.  
Squares D. (Pty) Ltd.: P.O. Box 4212, Luipaardsvlei, 1743.  
Spencer (Melksham) SA (Pty) Ltd.: P.O. Box 8621, Johannesburg, 2000. Tel. 680-3424.  
Switchboard Manufacturers (Natal) (Pty) Ltd.: P.O. Box 40086, Red Hill, 4071. Tel. (031) 838375.

**T**  
Theron R., Bouwer & Viljoen, Posbus 1155, Upington, 8800.  
Tel. 5481/2.  
Thorn Lighting SA (Pty) Ltd.: P.O. Box 43075, Industria, 2042.  
Tel. 839-2434.  
TM South Africa (Pty) Ltd.: P.O. Box 10465, Johannesburg, 2000. Tel. 36-3211.  
Trivets & Co. (Pty) Ltd.: P.O. Box 29026, Maydon Wharf, 4057.  
4077. Tel. (031) 251536.  
Truvelo Manufacturers (Pty) Ltd.: P.O. Box 14183, Verwoerdburg, 0140. Tel. ??????

**U**  
Uniplan (Pty) Ltd.: P.O. Box 7250, Johannesburg, 2000.  
Tel. 22-6971.  
Unie Ctaalkorporasie (van SA) Beperk: Posbus 48, Vereeniging, 1930. Tel. (016) 45122.

**V**  
Vaja Products (Pty) Ltd.: P.O. Box 35247, Northcliff, 2155.  
Tel. 678-1614.  
J. D. van Niekerk & Genote: Posbus 50645, Randburg, 2125.  
Tel. 46-6493.  
van Niekerk, Kleyn & Edwards: ICL House, Hertzog Blvd., Cape Town, 8001.

**W**  
Waco Distributors: P.O. Box 461, Johannesburg, 2000.  
Tel. 29-6141.  
Westinghouse Bellambi (Pty) Ltd.: P.O. Box 453, Johannesburg, 2000. Tel. 864-2150.  
Weyers Aab & Hubel: P.O. Box 174, Pretoria, 0001. Tel. 2-0921.

**Y**  
Yorkshire Switchgear SA (Pty) Ltd.: P.O. Box 157, Pinetown, 3600. Tel. (031) 72-1501.

**Z**  
Zakrzewski Associates Incorporated: P.O. Box 859, East London, 5200.

## PAST PRESIDENTS/VOORMALIGE PRESIDENTE

1915—17	* J. H. Dobson	Johannesburg	1950—51	C. R. Hallé	Pietermaritzburg
1917—19	* J. Roberts	Durban	1952—53	A. R. Sibson	Zimbabwe (Bulawayo)
1919—20	* B. Sankey	Port Elizabeth	1953—54	* J. C. Fraser	Johannesburg
1920—22	* T. C. W. Dodd	Pretoria	1954—55	G. J. Muller	Bloemfontein
1922—24	* G. H. Swingle	Cape Town	1955—56	* D. J. Hugo	Pretoria
1924—26	* J. Roberts	Durban	1956—57	J. E. Mitchell	Zimbabwe (Salisbury)
1926—27	* B. Sankey	Johannesburg	1957—58	J. L. van der Walt	Krugerdsorp
1927—29	* J. M. Lambe	East London	1958—59	C. G. Downie	Cape Town
1929—31	* R. Macauley	Bloemfontein	1959—60	* R. W. Kane	Johannesburg
1931—33	* L. L. Horrell	Pretoria	1960—61	R. M. O. Simpson	Durban
1933—34	* L. F. Bickel	Port Elizabeth	1961—62	C. Lombard	Germiston
1935—36	* G. G. Ewer	Pietermaritzburg	1962—63	P. A. Giles	East London
1936—37	* A. Rodwell	Johannesburg	1963—64	J. C. Downey	Springs
1937—38	* J. H. Gyles	Durban	1964—65	R. W. Barton	Welkom
1938—39	H. A. Eastman	Cape Town	1965—67	* D. Murray-Nobbs	Port Elizabeth
1939—44	* I. J. Nicholas	Umtata	1967—69	G. C. Theron	Vanderbijlpark
1944—45	* A. Rodwell	Johannesburg	1969—71	H. T. Turner	Umtali
1945—46	* J. S. Clinton	Zimbabwe (Salisbury)	1971—73	J. K. von Ahlfen	Springs
1946—47	* J. W. Phillips	Zimbabwe (Bulawayo)	1973—75	J. C. Waddy	Pietermaritzburg
1947—48	C. Kinsman	Bloemfontein	1975—77	E. de C. Pretorius	Potchefstroom
1948—49	A. Foden	Durban	1977—79	K. G. Robson	East London
1949—50	D. A. Bradley	East London	1979—81	P. J. Botes	Roodepoort
		Port Elizabeth			

\* Deceased/Oorlede

# How many times can you afford to make the same Cable Joint?

**Scotch SPEED SPLICE**  
 joints L.T. cable  
 in less than half the normal time.

In strictly controlled tests, carried out recently in South Africa, the Scotch Speed Splice, which uses no taping, heat or resin, took less than half the time compared with conventional splices.

And the new 'mini' Speed Splice can be used on Cables 4 mm<sup>2</sup> to 10 mm<sup>2</sup>.

**With 'Scotch' Splicing Systems, you're sure first time!**

Skimping on low-price Jointing Kits is false economy. Sooner or later, you'll probably have to do the whole job again! That's why you need 'Scotch' Splicing Systems; they last as long as the cable itself. They're made in South Africa, for South African conditions, using exclusive components developed in 3M's international laboratories.

Remember, 3M pioneered modern cable splicing techniques, both in South Africa and world-wide. What's more, they're backed by research resources no other manufacturer can match. Last year alone, 3M spent some R170 million on Research and Development.

With 'Scotch' Splicing Systems, you're sure - first time!

To: Electro Products Division 3M, P.O. Box 10465, Johannesburg, 2000.

Please contact me to arrange a demonstration of your 'Scotch' Speed Splice.

Name: \_\_\_\_\_

Position: \_\_\_\_\_

Company: \_\_\_\_\_

Telephone: \_\_\_\_\_

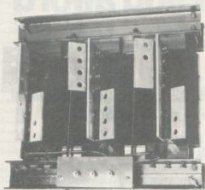
**Scotch Brand Splicing and Termination Systems**

Johannesburg: P.O. Box 10465 Tel: 36-3211 Cape Town: P.O. Box 4407 Tel: 51-7087 Port Elizabeth: P.O. Box 2279 Tel: 41-3536 East London: P.O. Box 594 Tel: 2-5238 Durban: P.O. Box 18040 Dalbridge Tel: 35-1916 Bloemfontein: P.O. Box 2100 Tel: 7-4211 Pretoria: P.O. Box 2717 Tel: 3-6222 Windhoek: P.O. Box 1527 Tel: 2-8565

# OIL & AIR COOLED TRANSFORMERS — REACTORS CHOKES — WIRE WOUND RESISTORS

BY

# OAK



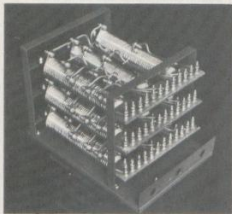
## TRANSFORMERS

Air cooled single and three phase to customers requirements for furnace, air field lighting, mine lighting or any special type of low or high voltage transformer.



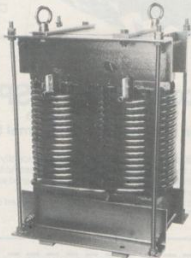
## REACTORS

Reactors and chokes manufactured for various applications. A. C. single phase & three phase D. C. and specials



## HEAVY DUTY RESISTORS

Heavy Duty Stud Rheostats Resistor Banks for Light Duty Starting.  
Close Transition Starters.



## CHOKES

Water cooled chokes for heavy current applications. Chokes for battery charging, thyristor drives, variable voltage drives. Converters, induction heating. Air cooled chokes.

**ALSO SUPPLIERS OF:— Distribution Transformers, Mini and Mobile Substations, Sectionalising Switches and H. T. Fuses**

Box 82271, Southdale 2135  
Marketing Division  
Head Office —  
Box 1172, Pietermaritzburg

Telephone: (011) 680-1422  
Telephone: (011) 834-1971

Telex 8-4086SA  
Telex 8-2778SA

Telephone: (0331) 5-1311

Telex 6-3428SA

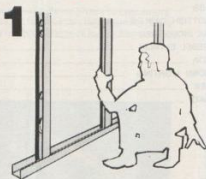
# OAK Industries (Transvaal) (Pty) Ltd

Subsidiary of OAK Industries (South Africa) (Pty) Ltd

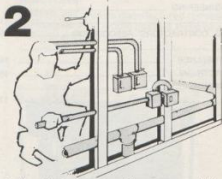
# ADVERTISERS — ADVERTEERDERS

	Page		Page
ABERDARE AYCLIFF CABLES .....	13	GYPSUM INDUSTRIES .....	204
AECI LTD. ....	8	HEINEMANN ELECTRIC .....	184
AFRICAN CABLES .....	4	HUBERT DAVIES .....	6
ASEA ELECTRIC .....	IFC	KLOCKNER-MOELLER .....	201
BANK OFS .....	168	3 M .....	179
BOSAL AFRIKA .....	130	H G MEISNER & CO. ....	94
BROWN BOVERI .....	16	NEDBANK .....	182
BOWTHORPE-HELLERMAN .....	148	PHOSWARE .....	1
CHEMILITE .....	150	POWER CONTRACTORS .....	OBC
CHEMICO .....	152	SULZER BROS. ....	7
CU AL ENGINEERING .....	2	SABS .....	121
ESCOM .....	118	SCOTTISH CABLES .....	IBC
ELECTRICAL CONTRACTORS' ASSOCIATION .....	154	OAK INDUSTRIES .....	37, 58, 63, 202
FARAD .....	3	STIEBEL ELTRON .....	103
FRITSCH FOELLNER .....	168	TCOA .....	51
FUCHS ELECTRICAL .....	160	THORN LIGHTING .....	10
FULMEN AFRICA .....	5	TREK .....	187
GOLNIX .....	174	USKO .....	193

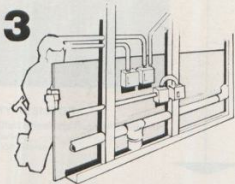
# It's light work wiring Rhino Drywall systems!



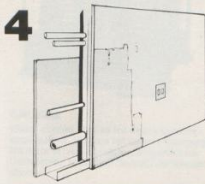
1. Once the carpenter (or drywall erector) has erected the framework . . .



2. the abundance of working space and the elimination of chasing make the plumber's and electrician's task a joy. It is convenient and time saving.



3. With the pipes and conduiting in place, the drywall erection team apply the Rhinoboard cladding to the framework,



4. leaving the electrician and plumber to provide the finishing touches in the form of plugs and cover plates before the painter decorates the finished wall.

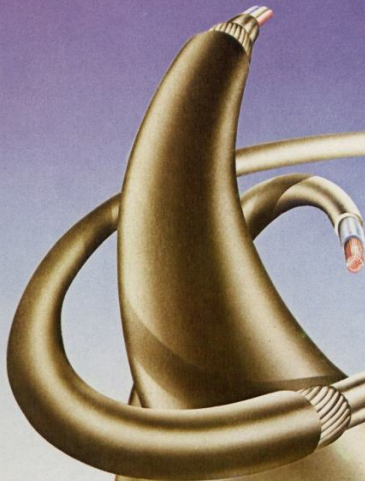
The resulting fully serviced and attractive wall is completed in a fraction of the construction time of a conventional wall!



**GYPSUM INDUSTRIES**

Head Office, Bedfordview 615-6470. Cape, Paarden Eiland 51-6021. OFS, Bloemfontein 74893. Natal, Pinetown 72-9236. Port Elizabeth 32-2948.

# More than a cable maker



Advanced power cables. And now a comprehensive range of associated products. In stock at regional centres throughout the country. Backed by the resources and development programmes of recognised leaders in world cable and electrical technology.

Important considerations in the cable business.



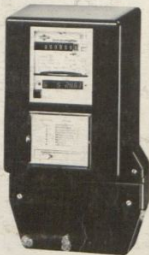
## Scottish Cables Limited

Head Office: P. O. Box 188, Pietermaritzburg, Tel. (0331) 61331  
Commercial Division: P.O. Box 2882, Johannesburg, 2000, Tel. (011) 613-5645 Regional  
Centres: Bloemfontein: Tel. 55228. Cape Town: Tel. 51-3339  
Durban: Tel. 25-3316. Port Elizabeth: Tel. 41-3199. Windhoek: Tel. 26219



# WHAT MAKES THIS METER DIFFERENT.

Simply, that it can do more than any supplier or consumer of electricity in the world has ever seen !



Firstly, it is a conventional Ferraris rotating disc three phase KWh meter. Secondly, it displays the average of the highest monthly KW maximum demand. But thirdly, the built-in micro-computer memorizes the previous 6-months, so that this meter need only be read twice a year, thus reducing administration costs substantially.

Even total power failures for as long as 12 months will not lose this information. Some of the world's largest supply authorities have tested this unique meter which, undoubtedly, will find its most important

application where the KVA MAXIMUM DEMAND affects monthly electricity costs.

The micro-computer is then pulsed by KVA signals of our proven KW/KVA TRANSDUCER. So, whatever the tariff structure is, this meter will accurately store all information until called for. Since the KVAh, which are accumulated over a measuring period, appear on a LED display, it is possible to determine the accurate average power factor over any measuring period.

**POWER CONTRACTORS (PTY) LTD**

P.O. Box 9236, Johannesburg 2000

Telephone: 683-3330/1/2. Telex: 8-9363