Agenda and Programme
36th CONVENTION
8th to 11th May, 1962
at East London

THE ASSOCIATION OF MUNICIPAL ELECTRICITY UNDERTAKINGS OF SOUTHERN AFRICA

Agenda en Program
36ste KONVENSIE
8ste tot 11de Mei, 1962
te Oos-Londen

DIE VERENIGING VAN MUNISIPALE ELEKTRISITEITS-ONDERNEMINGS VAN SUIDELIKE AFRIKA

Agenda and Programme
36th CONVENTION
8th to 11th May, 1962
at East London

THE ASSOCIATION OF MUNICIPAL ELECTRICITY UNDERTAKINGS OF SOUTHERN AFRICA

Agenda en Program
36ste KONVENSIE
8ste tot 11de Mei, 1962
te Oos-Londen

DIE VERENIGING VAN MUNISIPALE ELEKTRISITEITS-ONDERNEMINGS VAN SUIDELIKE AFRIKA

Notice of 36th Annual Convention

Notice is hereby given that the 36th Annual Convention of the Association will be held in the City Hall, East London, from the 8th MAY, to the 11th MAY, 1962, both days inclusive.

Davidson & Ewing (Pty.) Ltd.

per R. G. EWING,
Secretaries.

Kennisgewine van die 36ste Jaarlikse Konvensie

Hiermee word kennis gegee dat die 36ste Jaarlikse Konvensie van die Vereniging van 8 tot 11 Mei 1962 in die Stadsaal, Oos-Londen, gehou sal word.

Davidson & Ewing (Edms.) Bpk.

per R. G. EWING,
Sekretarisse.

AGENDA AND PROGRAMME

Monday, 7th May, 1962

9.30 a.m.—4.30 p.m. Meeting of Executive Council, Carlton Hotel.
6.30 p.m.—7.30 p.m. Civic Reception and Welcome, City Hall Quadrangle.

Tuesday, 8th May, 1962

8.45 a.m. Registration and Issue of Badges.
9.30 a.m. Welcome to East London by His Worship the Mayor of East London.
Official Opening by Professor A. F. P. J. Heydorn, Electricity Control Board.
Election of President.
Venue of next Convention.
10.30 a.m. Refreshment Interval.
11.00 a.m. Apologies and Greetings.
11.15 a.m. Presentations (Past President's and Honorary Members' Medals and Certificates).
11.30 a.m. Election of Executive Council.
11.45 a.m. Presidential Address.
12.45 p.m. Luncheon Adjournment.
2.30 p.m. Paper: "Some Aspects of Electricity Supply Economics" by Hugh H. Smith, M.Comm., Ph.D., Professor of Commerce at Rhodes University.
3.30 p.m. Refreshments.
4.00 p.m. Discussion on Paper.
5.00 p.m. Adjournment.
8.00 p.m. Film Premiere.

AGENDA EN PROGRAM

Maandag, 7 Mei 1962

9.30 vm.—4.30 nm. Vergadering van Uitvoerende Raad, Carlton Hotel.
6.30 nm.—7.30 nm. Burgerlike Onthaal en Verwelkoming Stadsaal, Binneplein.

Dinsdag, 8 Mei 1962

8.45 vm. Registrasie en Uitreiking van Kentekens.
9.30 vm. Verwelkoming in Oos-Londen deur Sy Edelagbare die Burgemeester van Oos-Londen.
Amptelike Opening deur Professor A. F. P. J. Heydorn, Elektrisiteitsbeheerraad.
Verkiesing van President.
Vergaderplek van volgende Konvensie.
Verkiesing van Vise-President.
10.30 vm. Verversings.
11.00 vm. Verskonings en Groete.
11.15 vm. Presentasies (Aftredene President en Erelede se Medaljes en Sertifikate).
11.30 vm. Verkiesing van Uitvoerende Raad.
11.45 vm. President se Rede.
12.45 nm. Verdaging vir Middagete.
2.30 nm. Referaat: „Sommige Aspekte van Elektrisiteitsvoorsieningsekonomie" deur Hugh H. Smith, M.Com.PL.D., Professor in Handel te Rhodes-Universiteit.
3.30 nm. Verversings.
4.00 nm. Besprekings van Referaat.
5.00 nm. Verdaging.
8.00 nm. Filmpremière.

Wednesday, 9th May, 1962

8.30 a.m.	Executive Council Meeting—Council Chamber.
9.30 a.m.	Convention Resumes. Communications from Council. Paper: "The Effect of Standardisation on the Economy of Electricity Supply", by A. A. Middlecote, B.Sc.(Eng.), M.S.A.I.E.E., South African Bureau of Standards.
10.30 a.m.	Tea.
11.00 a.m.	Paper: "Electricity Costs and Tariffs" by John H. West, M.B.E., B.A.,(Com.), M.Econ., F.I.S., Under-Secretary, Ministry of Finance, Federation of Rhodesia and Nyasaland.
12 noon	Discussion on Papers.
12.30 p.m.	Luncheon Adjournment.
2.30 p.m.	Paper: "The Development of a Power Station for an Isolated Community" by V. E. O. Barrett.
3.30 p.m.	Discussion on Paper.
4.30 p.m.	Adjournment.
8.15 p.m.	Members' Forum.
10.00 p.m.	Refreshments.

Thursday, 10th May, 1962

9.30 a.m.	Convention Resumes. Communications from Council. Annual Report of Secretaries. Appointment of Auditors. Discussion on Reports of Sub-Committees and Representatives. Discussion on Papers.
10.30 a.m.	Tea.
11.00 a.m.	Paper: "Load Factor and Consumer's Demand" by M. P. P. Clarke.
12.30 p.m.	Luncheon Adjournment.
2.30 p.m.	Visits to Car Distributors Assembly Limited and The Chloride Electrical Storage Co. S.A. (Pty.) Ltd., or alternatively Johnson & Johnson (Pty.) Ltd.
8.30 p.m.	Dinner Dance, City Hall.

Friday, 11th May, 1962

9.30 a.m.	Convention Resumes. Communications from Council. Discussion regarding Papers, Reports, etc.
10.30 a.m.	Tea.
11.00 a.m.	Closing Session.
12 noon	Meeting of Executive Council, Council Chamber.

Woensdag, 9 Mei 1962

8.30 vm.	Vergadering van Uitvoerende Raad, Raadsaal.
9.30 vm.	Konvensie word hervat. Mededelings van Raad. Referaat: „Die Effek van Standaardisering op die Ekonomie van Elektrisiteitsvoorsiening" deur A. A. Middlecote, B.Sc.(Eng.), M.S.A.I.E.E., S.A. Buro van Standaarde.
10.30 vm.	Teepouse.
11.00 vm.	Referaat: „Elektrisiteitskostes en -Tariewe" deur John H. West, M.B.E., B.A.(Com.) M.Econ. F.I.S., Ondersekretaris, Ministerie van Geldsake, Federasie van Rhodesia en Njassaland.
12.00 vm.	Bespreking van Referate.
12.30 nm.	Verdaging vir Middagete.
2.30 nm.	Referaat: „Die Ontwikkeling van 'n Kragsentrale vir 'n Geisoleerde Gemeenskap" deur V. E. O. Barrett.
3.30 nm.	Bespreking van Referaat.
4.30 nm.	Verdaging.
8.15 nm.	Lede-forum.
10.00 nm.	Verversings.

Donderdag, 10 Mei 1962

9.30 vm.	Konvensie word hervat. Mededelings van Raad. Jaarlikse verslag van Sekretarisse. Aanstelling van Ouditeure. Bespreking van Verslae van Onderkomitees en Verteenwoordigers. Bespreking van Referate.
10.30 vm.	Teepouse.
11.00 vm.	Referaat: „Belastingsfaktor en Verbruikersaanvraag" deur M. P. P. Clarke.
12.30 nm.	Verdaging vir Middagete.
2.30 nm.	Besoeke aan Car Distributors Assembly Ltd. en The Chloride Electrical Storage Co. (S.A.) Ltd., of Johnson & Johnson (Pty.) Limited.
8.30 nm.	Dinee/Dans, Stadsaal.

Vrydag, 11 Mei 1962

9.30 vm.	Konvensie word hervat. Mededelings van Raad. Bespreking van Referate, Verslae, e.d.m.
10.30 vm.	Teepouse.
11.00 vm.	Afsluiting.
12.00 vm.	Vergadering van Uitvoerende Raad, Raadsaal.

LADIES' PROGRAMME

Monday, 7th May, 1962

6.30 p.m.—7.30 p.m. Civic Reception, City Hall Quadrangle.

Tuesday, 8th May, 1962

8.45 a.m. Assemble for Registration, Issue of Badges and Official Opening.

10.30 a.m. Tea.

11.00 a.m. Apologies and Greetings.

11.15 a.m. Presentations (Past President's and Honorary Members' Medals and Certificates).

11.45 a.m. Presidential Address.
Free afternoon or alternatively visit to Wilson Rowntree (Pty.) Limited.

8.00 p.m. Film Premiere.

Wednesday, 9th May, 1962

p.m. Drive and morning tea with the Mayoress, East London Golf Club.

p.m. Visit to Berkshire Knitting (S.A.) Ltd. and Pineapple Research Station.

8.15 p.m. Members' Forum.

Thursday, 10th May, 1962

a.m. Free morning or alternatively visit to Wilson Rowntree (Pty.) Limited.

p.m. Visits to Car Distributors Assembly Limited and The Chloride Electrical Storage Co. S.A. (Pty.) Ltd. or alternatively Johnson & Johnson ((Pty.) Ltd.

8.30 p.m. Dinner Dance, City Hall.

Friday, 11th May, 1962

10.30 a.m. Assemble for Tea and Closing Session.

PROGRAM VIR DAMES

Maandag, 7 Mei 1962

6.30—7.30 nm. Burgerlike Onthaal, Stadsaal, Binneplein.

Dinsdag, 8 Mei 1962

8.45 vm. Vergader vir Registrasie, Uitreiking van Kentekens en Amptelike Opening.

10.30 vm. Teepouse.

11.00 vm. Verskonings en Groete.

11.15 vm. Presentasies (Aftredene President en Erelede se Medaljes en Sertifikate).

11.45 vm. President se rede.
Namiddag vry of besoek aan Wilson Rowntree (Edms.) Bpk.

8.00 nm. Filmpremière.

Woensdag, 9 Mei 1962

vm. Plesierrit en oggendtee saam met Burgemeestersvrou, Oos-Londense Gholfklub.

nm. Besoek aan Berkshire Knitting (S.A.) Bpk., en Pynappelnavorsingstasie.

8.15 nm. Lede-forum.

Donderdag, 10 Mei 1962

vm. Vry oggend of besoek aan Wilson Rowntree (Edms.) Bpk.

nm. Besoeke aan Car Distributors Assembly Ltd. en The Chloride Electrical Storage Co. S.A. (Pty.) Ltd. of Johnson & Johnson (Pty.) Ltd.

8.30 vm. Dinee/Dans, Stadsaal.

Vrydag, 11 Mei 1962

10.30 vm. Vergader vir Tee en Afsluiting.

Address

by P. A. GILES

Departmental Administration.

In the past it has been the privilege of those elected to the office of President of this Association to choose freely of any topic as the subject for this address and in exercising this concession I venture to speak to you on the objectives associated with the administration of a Municipal Electricity Department.

This is a subject which comes under the purview of both Councillor and Engineer members of the Association and is one that in my opinion merits attention at all times, being of significance and importance in the promotion of productive activity. The implications are broad in scope and much of which is proposed to be said can be characterised as commonsense or non-controversial in nature. However, experience has shown that in many cases the ideas and thinking forming the basis or the background of the remarks which follow are not self-evident and it is suggested that a restatement of the purposes of the details of administration can be both valuable and constructive.

With a view to clarification at the outset it is suggested that certain terms which shall be used should be defined. In a dictionary sense the purpose of administration is to direct. In some quarters it is suggested that this resolves itself into two main functions. To determine and to manage. These are regarded as separate functions and both arise in the first instance out of a directive given.

The determinative aspect is normally in the hands of the Council and calls for the formulation of a policy in respect of labour, finance and organisation.

The management aspect is taken to be the responsibility of the heads of departments who carry out the policy laid before them.

A policy is generally regarded as a course of action determined by the Council for the guidance of the Departments who thus become aware of the precise aims and objectives of the Councillors. In this way policy provides the Departments with a defined objective which is valuable as a guide to planning. Under present conditions one imagines that a definite objective would be economy in all branches and that the plan for achieving this would be selective in its application. Whatever plan is decided upon would necessitate an examination of the functions of management in the light of the permanent and important requirements of Municipal Administration to enable a selective and objective approach to be made to the problems of economy and efficiency. Any time devoted to such a study would be well spent.

In a large organisation the lines of relationship and demarcation between the determinative aspects of administration in the hands of the Council and the management aspects in the hands of the departmental heads tend to become more clearly defined and separate than is the case in a small concern.

Rede

Deur P. A. GILES

Departementele Administrasie.

In die verlede was dit die voorreg van diegene wat tot die Voorsittersamp van hierdie Vereniging verkies is om vryelik enige onderwerp te kies vir hierdie rede en by die uitoefening van hierdie toegewing waag ek dit om u toe te spreek oor die doelstellings wat met die administrasie van 'n Munisipale Elektrisiteitsdepartement gepaard gaan.

Hierdie is 'n onderwerp wat beide Raadslid- en Ingenieurslede van die Vereniging raak en wat, na my mening, ten alle tye aandag verdien aangesien dit van betekenis en belang is in die bevordering van produktiewe aktiwiteit. Die implikasie is breed in omvang en baie van wat ek voornemens is om te sê kan as onbetwisbare gesonde verstand bestempel word. Die ondervinding het egter getoon dat in baie gevalle die denke en idees wat die grondslag of agtergrond vorm van die hieropvolgende aanmerkings nie vanself blyk nie en ek gee aan die hand dat 'n herhaling van die administratiewe detail beide waardevol en opbouend kan wees.

Duidelikheidshalwe word voorgestel dat sekere terme wat gebruik gaan word uit die staanspoor omskryf moet word. In 'n woordeboeksin is die doel van administrasie om te bestuur. In sommige kringe word aan die hand gedoen dat dit homself in twee hooffunksies ontleed. Om te beslis en te bestuur. Hierdie word beskou as twee aparte funksies en beide het in die eerste instansie hulle oorsprong in 'n opdrag wat gegee word.

Die beslissende aspek is normaalweg in die hande van die Raad en dit vereis die formulering van 'n beleid ten opsige van arbeid, finansies en organisasie.

Die bestuursaspek word beskou as die verantwoordelikheid van departementshoofde wie die beleid wat hulle voorgelê word moet uitvoer.

'n Beleid word in die algemeen beskou as 'n wyse van optrede wat deur die Raad voorgeskryf word as leidraad vir Departemenshoofde wie dan op diè wyse bewus word van die juiste mikpunte en doelstellings van die Raadslede. Op hierdie wyse verstrek beleid die Departement met 'n duidelike mikpunt wat 'n waardevolle gids by beplanning is. In die huidige omstandighede stel mens jou voor dat besparing in alle vertakkings 'n definitiewe doelwit sal wees en die plan wat beraam word om dit te bereik selektief toegepas sal word. Watter plan ookal aanvaar word sal 'n ondersoek na die bestuursfunksies in die lig van belangrike en permanente vereistes van Munisipale Administrasie noodsaaklik wees teneinde 'n selektiewe en objektiewe benadering tot die vraagstukke van besparing en doeltreffendheid moontlik te maak. Enige tyd wat aan so 'n ondersoek gewy word sal goed bestee wees.

In 'n groot organisasie, anders as in klein ondernemings, neig die verwantskaps- en skeidingslyne tussen die beslissende aspek van administrasie in die hande van die Raad en die bestuursaspekte in die hande van Departementshoofde om meer en meer duidelik omskryf en van mekaar afgesonderd te word.

This division becomes especially striking when an examination of the results achieved discloses that more efficient utilisation of the work of the staff is necessary and essential.

The needs that then become seen lead towards improvements in the shape and structure of the organisation and the management, control and application of the staff energies and activities.

To achieve these improvements it is usually incumbent upon an administrative authority to promote the efficient routing of work items, to evolve orderly procedures, to institute departmentalisation, to define specialisation and to systemise the productive and routine work of the departments.

The aims lead to the formulation of courses of action and in regard to departmentalisation, given hereunder is a list, not necessarily complete of the suggested functions of a department dealing with the management of an Electricity Supply Undertaking.

Experience has shown that in municipal work, as elsewhere, the urgent is often the enemy of the important. Very frequently the need for decision and action on immediate emergencies seems to preclude a study of an existing organisation which is essential as a basis for achieving efficiency. Very often the neglected problems of the past suddenly arise in their new importance and become the new emergencies to which quick response is necessary, generally with improvisations that may prove uneconomical in the long run. It follows therefore that it is preferable to operate on an organised rather than an emergency basis when dealing with long term management tasks and problems.

In regard to these matters, there is a considerable body of principle that can be taught but each undertaking is required to develop its own method of approach to the work and ascertain where the emphasis has to be placed.

In municipal work, according to some authorities, any study of an existing organisation would empasise that the Councillors should confine themselves to essentials and have proper data presented to them to enable the right decisions to be made; that arrangements are made for the proper delegation of authority to committees and heads of departments; that steps are taken to ensure that there is close co-operation between departments; that sufficient time is given to the management to plan for the future and that for day-to-day working the system should be largely decentralised with responsibility carried well down the line.

Functions of Administration.

It is generally accepted that any rules for the administration of an organisation should establish and limit the rights and duties of every office and position in the concern in such a way, as, so far as possible, to bring about for both the present and the future, an assured order and harmonious co-operation, to thereby ensure the success of the whole as well as the welfare of the individual.

The Council, it has been suggested, should concern itself with and limit itself to the working out of the general policies and plans, and exercise co-ordination, supervision and control

Hierdie verdeling word veral treffend wanneer 'n ondersoek van reeds behaalde resultate openbaar dat 'n meer doeltreffende gebruik van die personeel noodsaaklik is.

Gebreke wat dan openbaar word lei tot verbetering in die struktuur van beheer en organisasie en die beheer oor en aanwending van die personeel se energie en werksaamhede.

Teneinde hierdie verbetering te bewerkstellig is dit gewoonlik die plig van die administratiewe owerheid om die doeltreffende verdeling van werksitems te bevorder, ordelike werksprosedures te ontwikkel, departementalisasie in te stel, spesialisasie te omskryf en die produktiewe en roetine werk van die departement op stelselmatige voet te plaas.

Hierdie doelstelling lei tot aksiebeplanning en sover departementalisasie betref word hieronder 'n lys aangegee wat nie noodwendig volledig is nie, van die voorgestelde funksies van 'n departement wat handel met die bestuur van 'n elektrisiteitsvoorsieningsonderneming.

Die ondervinding het geleer dat in munisipale werk, net soos op ander gebiede, dringende sake gewoonlik die vyand is van ander wat belangrik is. Baie dikwels sluit die noodsaaklikheid vir beslissings en optrede in verband met 'n onmiddellike noodstoestand die bestudering van 'n bestaande organisasie wat vir die bereiking van doeltreffendheid noodsaaklik is skynbaar uit. Dikwels neem die verwaarloosde probleme van die verlede skielik nuwe gedaantes aan en word hulle die noodstoestande van die hede wat snelle handeling, dikwels deur improvisasie wat op lange duur gewoonlik onekonomies is, noodsaaklik maak. Dit spreek dus vanself dat dit verkieslik is om te werk te gaan op 'n georganiseerde eerder as op 'n noodsbasis wanneer met langtermyn bestuurstake en -probleme gehandel word.

In hierdie verband is daar 'n aansienlike aantal beginsels wat aangeleer kan word, dog van elke onderneming word verlang dat hy sy eie benaderingsmetode tot die werk moet ontwikkel en self moet vasstel waarop die klem geplaas moet word.

In Munisipale werk sou enige studie van die bestaande organisasie, volgens sommige gesaghebbendes, benadruk dat Raadslede hulle sal bepaal by noodsaaklike dinge en dat behoorlike gegewens aan hulle voorgelê sou word teneinde hulle in staat te stel om tot die korrekte beslissings te geraak; dat reëlings getref sou word vir die behoorlike delegering van gesag aan komitees en departementshoofde, stappe gedoen word om 'n noue samewerking tussen departemente te verseker, dat aan die bestuur voldoende tyd gegee sou word om die toekoms te beplan en dat die stelsel, vir die doeleindes van daaglikse werksaamhede, grotendeels gedesentraliseerd sal wees met verantwoordelikheid wat so verdeel is dat die laere range ook daarin sal deel.

Administratiewe Funksies.

Algemeen word aanvaar dat enige reëls vir die bestuur van 'n organisasie die regte en pligte verbonde aan elke pos moet vasstel en beperk op so 'n wyse dat vir die hede en die toekoms 'n versekerde en harmonieuse samewerking daargestel kan word en die sukses van die geheel sowel as die welsyn van die indiwidue sodoende verseker word.

Daar is aan die hand gegee dat die Raad homself moet bemoei met en beperk tot die formulering van algemene

but should not concern itself with the day-to-day activities of management.

1. It is clear that it is essential for the Department to offer to the Council an administration which serves the Council's wishes as defined in policy decisions or statements.

2. The Department should co-ordinate with other Departments but at the same time be objective and imparital in its outlook and the relations and workings between the Department Heads should permit of the maximum initative and latitude within the framework of the Council's policies.

3. The Department should provide an agenda covering all pending business supported by complete reports on every decision required of the Council, so constructed and modulated as to impress the public with the way the Council conducts its affairs.

4. A procedure should be evolved to establish public relations between the Department and the business people, civic groups and consumers which makes each party feel that it has the friendly co-operation of the Department and Council.

5. Arrangements should be made, that whenever contact between the Department employee and the public occurs, the actions and behaviour of the employees reflect the policies of the Council.

6. The Department should arrange for regulations to be worked to and which govern each situation as completely and wisely as possible, which are defensible in court, which provide equal treatment, which are clear of repetitions and references, which are properly modified and are readily understandable by the public.

7. Provision should be made for an uncomplicated costing and accounting system which renders reports of revenue and expenditure at any time, which provides financial detail promptly so as to control expenditure and transactions, which pays accounts promptly and passes the scrutiny of annual and provincial audits smoothly.

8. A personnel programme which is sensitive to Council wishes yet provides effective staff workers and relieves the Council of involvement in supervisory problems should be instituted.

9. The Department should provide a complaints service geared to local conditions and to the human side of life providing maximum protection and services to consumers with complaints handled promptly, efficiently and courteously.

10. The Department should establish an electrical inspections service which observe all the codes, standards and regulations, yet which is realistic in recognising consumer and contractor problems.

11. The Department should arrange for a legal service which meets the letter of the law laid down by the Electricity Act and other Government, Provincial and local laws and regulations to protect the interests of the Council and to provide a means to avoid stultifying the Council's action where this is possible.

planne, 'n algemene beleid en die uitoefening van ko-ordinasie, toesig en beheer, maar hom nie behoort in te meng met alledaagse bestuursaktiwiteite nie.

1. Dis duidelik noodsaaklik dat die Departement aan die Raad 'n administrasie verskaf wat die Raad se planne soos in beleidsverklarings en -beginsels uiteengesit sal uitvoer.

2. Die Departement moet met ander Departemente koordineer maar moet terselfdertyd objektief en onpartydig wees in sy uitkyk en die verhoudinge en werkverrigting tussen hoofde van Departemente behoort die maksimum van inisiatief en speling binne die raamwerk van die Raad se beleid toe te laat.

3. Die Departement moet 'n agenda opstel, gestaaf deur volledige verslae oor alle hangende sake wat Raadsbesluite verg, op so 'n wyse dat die publiek beïndruk word deur die wyse waarop die Raad sy werksaamhede verrig.

4. 'n Prosedure behoort uitgewerk te word waardeur verhoudings tussen die Departemente, die sakegemeenskap, burgerlike groepe en verbruikers geskep word wat elke groep sal laat voel dat dit die vriendelike medewerking van die Departement en die Raad geniet.

5. Daar behoort gereël te word dat die optrede en gedrag van werknemers die beleid van die Raad weerspieël wanneer die werknemer ookal met lede van die publiek in aanraking kom.

6. Die Departement moet reëlings tref vir werksregulasies wat elke situasie so volledig en verstandelik moontlik dek, wat in 'n Hof geregverdig kan word, vir gelyke behandeling voorsiening maak, vry is van herhalings en verwysings, behoorlik gekodifieer is en wat deur die publiek geredelik verstaan kan word.

7. Voorsiening moet gemaak word vir 'n ongekompliseerde stelsel van kosteberekening en boekhouding waaruit te eniger tyd verslae van inkomste en uitgawes opgestel kan word, wat finansiële besonderhede geredelik versterk sodat uitgawes en transaksies beheer kan word, rekenings onmiddellik vereffen kan word en wat tog die toets van die jaarlikse Provinsiale oudit kan deurstaan.

8. 'n Personeelprogram moet ingestel word wat voeling hou met die wense van die Raad en tog voorsiening maak vir 'n doeltreffende werkspersoneel en dus die Raad vrystel van toesighoudende probleme.

9. Die Departement moet voorsiening maak vir 'n klagtediens wat ingeskakel is met plaaslike omstandighede en die menslike sy van die lewe, wat aan verbruikers op doeltreffende en beleefde wyse die maksimum beskerming en diens bied in verband met die spoedige afhandeling van klagtes.

10. Die Departement moet 'n elektriese inspeksiediens instel wat alle kodes, standaarde en regulasies nakom en tog realisties is in die erkenning van verbruikers en kontrakteurs se probleme.

11. Die Departement moet reël vir 'n regsdiens wat voldoen aan die letter van die wet soos neergelê deur die Elektrisiteitswet en ander Regerings- en Provinsiale wette, plaaslike verordeninge en regulasies, die belange van die Raad beskerm en as 'n middel dien om sover moontlik te verhoed dat die Raad se handelinge verydel word.

12. The establishment of beneficial relations with adjoining Municipalities, Government and Provincial Departments which gain for the Council the maximum advantage and harmony in governmental relations should be fostered.

13. A planning programme should be drawn up which recognises the limits of basic requirements from time to time and balances the rate of development to the City's needs.

14. A tariff structure should be worked out which provides sufficient funds to operate the service and meet outgoings properly chargeable to revenue yet which is reasonable in its demands on the groups charged and recognises their limitations in sharing costs.

15. Provision should be made for co-ordination, procedure and facilities within the Department and in relation to other departments, aimed at maximum efficiency fully accepted by those involved.

16. Arrangements should be made to provide a records system which is systematic permanent and accurate, yet simple enough to produce documents and plans without undue delay or confusion.

17. Provision should be made for a budget which makes for easy consideration in open Council; which can be heard publicly by the Council without doubt as to its correctness; which can be considered in full participation by the Council, ratepayers associations and ratepayers meetings, which is related precisely to the accounting system, which contains a minimum margin of estimates error, which comprehends all sensible departmental needs as regards maintenance of assets and capital improvements programmes, which provides sufficient funds for budgetted services and withal is not inflated.

It is suggested therefore that these are the heads under which the function or management in the administrative sense, excluding the technical aspects, could be listed in respect of a Municipal Electricity Undertaking. The major function of the Department is probably the preparation of the budget as this epitomises the work of the undertaking in the denominator common to all Departments, that of money, and makes provision for the necessary finance to work and develop. For these reasons it is proposed to enlarge in this topic in the next few paragraphs.

The Budget.

The preparation of the budget is the most important administration event of the year bringing all Departments together in detailed consideration of the operation and future of the undertaking in the general development of the City Council's activities. The manner and emphasis of these considerations and deliverations vary but in general the trend is to review probable operations over a period of a year or years and prepare an estimate of cash resources to meet the needs of the programme envisaged. In spite of its brevity the word budget is one of the most complex in the language because of the number of procedures to which the word is applied. It is generally accepted that four classifications can be distinguished.

12. Die daarstelling van voordelige verhoudinge met omliggende Munisipaliteite, Staats- en Provinsiale Departemente wat vir die Raad die grootste voordeel en harmonie in sy onderhandelinge met die owerhede sal verseker moet bevorder word.

13. 'n Beplanningsprogram moet opgestel word wat die perke van die basiese vereistes van tyd tot tyd erken en die tempo van ontwikkeling balanseer met die stad se behoeftes.

14. 'n Tariefstruktuur moet uitgewerk word wat voldoende fondse sal verskaf om die diens te laat vlot en uitgawes wat behoorlik teen inkomste gedebiteer behoort te word te kan dek maar wat tog redelik is in sy eise teen die groepe op wie hy druk en hulle beperkings om in die koste te deel erken.

15. Voorsiening moet gemaak word vir ko-ordinasie, werksmetodes en fasiliteite binne die Departement en in verhouding tot ander departemente wat maksimum doeltreffendheid ten doel het en ten volle deur die daarby betrokke persone aanvaar word.

16. Reëlings moet getref word vir 'n permanente, stelselmatige en akkurate rekordstelsel wat tog eenvoudig genoeg is om rekords en planne sonder onnodige vertraging of verwarring te voorskyn te bring.

17. Daar moet gesorg word vir 'n begroting wat gerieflik in 'n ope Raadsvergadering behandel kan word, in die openbaar deur die Raad bespreek kan word sonder dat aan die juistheid daarvan getwyfel word, wat met volle deelname deur die Raad, belastingbetalersverenigings en vergaderings oorweeg kan word, presies aan die boekhoustelsel verwant is, 'n minimum van speelruimte met skattings bevat, alle merkbare departementele behoeftes in verband met die instandhouding van bates en kapiltale verbeteringsprogramme insluit en wat voldoende fondse vir begrotingsdienste sonder inflasie voorsien.

Daar word aan die hand gedoen dat hierdie die hoofde is waaronder die funksie of bestuur in die administratiewe sin, met uitsluiting van die tegniese aspek in die geval van 'n Munisipale Elektrisiteitsonderneming ingedeel kan word. Die vernaamste funksie van die Departement is waarskynlik die opstel van 'n begroting, aangesien dit die werk van die hele onderneming saamvat in die aanduier wat alle Departemente in gemeen het, nl. die van geld, en ook terselfdertyd voorsiening maak vir die nodige middele om te kan werk en uitbrei. Om hierdie redes word in die volgende paar paragrawe oor hierdie onderwerp verder uitgebrei.

Die Begroting.

Die opstel van die begroting is die mees belangrike administratiewe gebeurtenis van die jaar want dit bring alle Departemente bymekaar in 'n uitgebreide oorweging van die werking en toekoms van die onderneming in die algemene ontwikkeling van die Stadsraad se werksaamhede. Die metode en nadruk van hierdie beraadslagings en oorwegings verskil, dog in die algemeen bestaan die neiging om die waarskynlike werksaamhede oor 'n tydperk van 'n jaar of jare in oënskou te neem en om beramings van kontantbronne waaruit aan die behoeftes van die beoogde program voldoen kan word voor te berei. Sy bondigheid ten spyt is die woord „begroting" een van die mees gekompliseerde in ons taal vanweë die aantal prosedures wat daaronder begryp word. Algemeen word aangeneem dat vier klassifikasies onderskei kan word.

1. The budget may be a plan which groups together the various projects which through the year or proceeding years the Council has decided will merit consideration to meet the needs of the public services.

2. The budget may be a forecast of the results expected when consideration is given to the income and expenditure relating to the projects and services under the plan previously drawn up.

3. The budget may be an authorisation to the officials to operate on the estimates of revenue and expenditure authorised by the Council.

4. The budget may be yardstick of what expenditure and revenue ought to be if the organisation is working efficiently.

The underlying feature of a budget, whatever the classification, is a programme of work to be done, or services to be produced to fulfil the objects of the organisation and the manpower and materials needed to accomplish these objectives.

The plan for the budget of a Municipal Electricity Department is mainly technical and is based on the output required to follow the demand which is largely outside of the control of the undertaking. The budget must therefore be founded on estimates of sales or demand. Sound forecasting of probable load is a pre-requisite of the budget. These forecasts must be drawn up in the light of present trends, the anticipated effects of planned developments in methods of generations and distribution and any likely charges in external circumstances which may effect demand. The annual forecast of demand is usually a more detailed refinement of the longer range estimates for planning capital development. Estimates of demand three to seven years ahead are necessary to allow sufficient time to cover Municipal formalities and installation of equipment to produce the output required.

The forecast of the results of a budget is the most agonising period for Municipal Councillors and is an annual process wherein their personal judgments are given expression and reality. This forecast budget is generally in the form of preliminary estimates of probable costs of items deemed desirable by Councillors as ratepayers representatives and the revenue that may be accrued by reason of establishment of these projects. The annual estimate budget may be regarded as a master plan for allocating limited resources between all the different activities that have to be financed from a central pool. This has to be done by weighing the competing claims of different services, deciding what marginal items have to be sacrificed, and examining every possible combination of alternatives to find what will further the public interest more than can be done in any other way with the funds available. There seems to be no simple measureable financial test for determining the best combination and in a democratic system what finally decides the issue is what the Councillors think will be most acceptable to the community as a whole. However, the Municipal Electricity Department is usually regarded as a commercial enterprise with a specific duty to operate on commercial principles and to see that the income from tariff recovery is not less than sufficient to cover expenditure on

1. Die begroting mag 'n plan beteken wat die verskillende skemas saam groepeer wat deur die jaar of volgende aantal jare na mening van die Raad oorweging sal verdien teneinde aan die openbare behoeftes te voorsien.

2. Die begroting mag 'n voorspelling wees van verwagte resultate wanneer oorweging geskenk word aan inkomste en uitgawes in verband met skemas en dienste onder 'n voorheen opgestelde plan.

3. Die begroting mag beteken 'n magtiging aan amptenare om op te tree onder die beraming van inkomste en uitgawes deur die Raad goedgekeur.

4. Die begroting mag 'n maatstaf wees van wat inkomste en uitgawes behoort te wees as die organisasie doeltreffend werk.

Die kenmerk wat 'n begroting ten grondslag lê, afgesien van sy klassifikasie, is 'n program van werk wat gedoen of dienste wat gelewer moet word teneinde die doelwit van die organisasie te bereik en die mannekrag en materiaal wat benodig word om hierdie doelstelling te bereik.

Die begrotingsplan van 'n Munisipale Elektriesiteitsdepartement is grotendeels tegnies en is gebaseer op die produksie wat nodig is om te voldoen aan die aanvraag wat grotendeels buite die beheer van die onderneming is. Die begroting moet derhalwe gebaseer wees op beramings van verkope of aanvraag. 'n Gesonde voorspelling van die waarskynlike lading is 'n voorvereiste van die begroting. Hierdie voorspellings moet opgestel word in die lig van huidige neigings, die verwagte resultate van beplande ontwikkeling in metodes van kragopwekking en -distribusie en enige waarskynlike veranderings in eksterne omstandighede wat die aanvraag kan affekteer.

Die jaarlikse voorspelling van aanvraag is gewoonlik 'n breedvoerige verfyning van die langtermyn beramings vir die beplanning van kapitale ontwikkeling. Beramings van aanvraag vir tydperke van drie tot sewe jaar vooruit is noodsaaklik teneinde voldoende tyd toe te laat vir Munisipale formaliteite en die installering van toerusting om die benodigde produksie te kan lewer.

Die voorspelling van die uitwerking van 'n begroting is vir Munisipale Raadslede 'n mees angsvolle tydperk en dis 'n jaarlikse proses waarin aan hulle persoonlike oordeel uidrukking en werklikheid gegee word. Hierdie beraamde begroting is gewoonlik in die vorm van voorlopige beramings van die moontlike koste van items wat deur die Raadslede as verteenwoordigers van die belastingbetalers wenslik geag word en die inkomste wat verkry mag word weens die instelling van hierdie skemas. Die jaarlikse beraamde begroting kan beskou word as 'n meestersplan vir die toewysing van beperkte hulpmiddele tussen al die verskillende aktiwiteite wat uit 'n sentrale bron gefinansier moet word. Dit moet gedoen word deur die mededingende aansprake van verskille dienste teen mekaar op te weeg, te besluit watter marginale items opgeoffer moet word en elke moontlike kombinasie van keuses te ondersoek om vas te stel wat die openbare belang tot 'n groter mate sal bevorder as wat anders met die beskikbare fondse gedoen kan word. Daar is skynbaar geen eenvoudige meetbare finansiële toets om die beste kombinasie te bepaal nie en in 'n demokratiese stelsel is dit dié wat die Raadslede as die mees aanneemlik vir die gemeenskap as 'n geheel beskou wat uiteindelik die deurslag gee. Die Munisipale Elektrisiteitsdepartement word gewoonlik as 'n sakeonderneming beskou met 'n spesifieke plig om op besigheidsbeginsels te werk en toe te sien dat die inkomste

revenue account over a period of years and for this reason does not appear to be such a problem for Councillors.

The authorisation budget is the final set of figures approved by the Council as the estimates for the year and represents a plan of activity bounded by the authority to spend certain sums or employ certain quantities of manpower and material for specified purposes. It is a set of financial documents drawn up by accountants to distinguish between the two main types of financial transactions in Municipal work, capital expenditure and revenue. A capital expenditure budget is devoted to the proposed acquisition and disposals of fixed assets. A revenue budget contains the expenditures incurred in maintaining the assets and the estimated income to be derived from the electricity tariffs.

Finally, the budget or approved estimates can be used as a yardstick to test the success of the works undertaken for the purpose of attaining the given objectives. With a proper accounting system the Council can use the budget as a means of exercising control over the various departments and in this respect is a valuable aid to management both for formulating policy and keeping a check on its execution. This particular application of budgeting is a major factor leading to efficiency in administration and has some significance in view of the considerable expenditure by Municipal Electricity Undertakings in this country.

In the larger undertakings top management handle the urgent and important business of the day and they require formalised procedures to assist them in decision making and supervision of their subordinates. The budget is of considerable assistance in this respect and helps in promoting order and systematic planning of the departments work.

Efficiency.

It may now be advantageous to pass on to certain questions that arise regarding the attainment of efficiency in management and how this can be achieved. Would it not for example be advantageous to use the budget system to promte efficiency? What in fact are the practical limits to endeavour in achieving efficiency? What is efficiency in terms of the functions of the department? It might be timely to consider these questions in the light of prevailing practice.

A system of management in a Municipal Electricity Undertaking is expected to fulfill two major requirements in the economic sense.

(a) Devise and operate a public electricity service of adequate capacity to meet the demands of the consumers.

(b) Improve the operating ratio of expenditure to revenue by day to day control of expenditure.

The first is covered by the capital expenditure budget and the second by the revenue budget.

The answer to the first question raised is that it is advantageous to use the budget to promote efficiency especially by improving the operating ratio of expenditure to revenue. The

verkry uit die verkoop van krag nie minder is as wat oor 'n tydperk van jare uitgawes uit inkomsterekening kan dek nie; om hierdie rede is dit skynbaar nie so 'n vreeslike probleem vir Raadslede nie.

Die magtigingsbegroting is die finale stel syfers wat deur die Raad goedgekeur word as die beramings vir die jaar en dit verteenwoordig 'n plan vir werksaamhede wat beperk word deur die magtiging om sekere bedrae uit te gee en sekere hoeveelhede mannekrag en materiaal te gebruik vir gespesifiseerde doeleindes. Dis 'n stel finansiële dokumente deur rekenmeesters opgestel om te onderskei tussen die twee hooftipes van finansële transaksies in Munisipale werksaamhede — kapitaaluitgawes en uitgawes op inkomsterekening. 'n Begroting van Kapitale uitgawes word gewy aan die voorgestelde verkryging van en geskikking oor vaste bates. 'n Begroting op Inkomsterekening bevat die uitgawes aangegaan vir die instandhouding van die bates en die beraamde inkomste wat uit die elektrisiteitstariewe verkry moet word.

Ten slotte kan die begroting of goedgekeurde beramings gebruik word as 'n maatstaf om die mate van sukses van die skemas wat onderneem word om die gegewe doelstellings te bereik mee te meet. Met 'n behoorlike rekeningstelsel kan die Raad die begroting gebruik om beheer uit te oefen oor die verskillende Departemente en in hierdie opsig is dit 'n waardevolle hulpmiddel in die hande van die bestuur beide om 'n beleid te kan formuleer en die uitvoering daarvan te kan kontroleer. Hierdie besondere toepassing van die begroting is een van die belangrikste faktore wat bydra tot doeltreffendheid in die bestuur en is nogal van betekenis as in aanmerking geneem word die aansienlike bedrae wat deur Munisipale Elektriese ondernemings in ons land uitgegee word.

In die grotere ondernemings hanteer die hoogste bestuursrange die belangrike en dringende sake van die dag en hulle het geformaliseerde prosedures nodig om hulle te help om tot 'n beslissing te geraak en toesig te hou oor hulle onderhoriges. Die begroting is in hierdie opsig van aansienlike hulp en dit help om orde en 'n stelselmatige beplanning van die Departement se werk te bevorder.

Doeltreffendheid.

Dit mag voordelig wees om oor te stap na sekere vraagstukke betreffende die bereiking van bestuursdoeltreffendheid en hoe dit verkry kan word. Sal dit byvoorbeeld nie voordelig wees om die begrotingstelsel te gebruik om doeltreffendheid te bevorder nie? Wat is in werklikheid die praktiese perke in 'n strewe om doeltreffendheid te bereik? Wat is doeltreffendheid in terme van die funksies van die departement? Dis miskien tyd dat hierdie vraagstukke oorweeg word in die lig van die heersende praktyk.

'n Stelsel van bestuur in 'n Munisipale elektrisiteitsonderneming moet aan twee belangrike vereistes in die ekonomiese sin voldoen.

(a) 'n Openbare elektrisiteitsdiens ontwerp en voortsit wat van afdoende kapasiteit is om in die aanvraag van verbruikers te voorsien.

(b) Die bedryfsverhouding van uitgawes tot inkomste verbeter deur van dag tot dag beheer uit te oefen oor uitgawes.

Die eerste word gedek deur die begroting van kapitaal uitgawes en die tweede deur die inkomstebegroting.

main emphasis would lie in expenditure, a portion of which is flexible in relation to revenue which to a great extent is out of the control of the Department. The success of the system would depend on how far the budget makes those who work within it constantly aware of the results that their actions and decisions have on the financial operations of the department.

In regard to the second question relating to the practical limits to endeavour in achieving efficiency, these limits are determined by an examination of the organisation and management of the organisation. Organisation being considered as the structure or form of the business side of the undertaking, the form being designed to achieve the necessary co-ordination of the separate functions. Management being regarded as the controlling influence on the organisation; directing the operation of the several parts of the undertaking, ensuring its smooth and efficient working. The budget would provide for the proper superintendence of the practical limits in attaining efficiency as disclosed by work study procedure in relation to staff activities. Care must be taken in determining these practical limits to provide understanding of the procedures to the staff. Experience has shown that many attempts to achieve efficiency have failed to achieve the results expected because of the neglect of the effects of efficiency changes on the staff.

In regard to efficiency this means different things in different industries and organisations and according to some authorities three different ideas in relation to this matter require to be distinguished. The first is effectiveness, or the degree of success with which the objective is achieved. The second is economy or the cost of the effectiveness in money, manpower or materials. The third is efficiency itself which is the ratio of effectiveness to economy. It is of no benefit to the Department for the work to be done regardless of cost nor that insufficient money is provided to do the work effectively. The aim of efficiency is to get the best of two worlds and this is difficult of attainment.

The idea of efficiency resolves itself into three parts.

Technical efficiency covering the use of machines.

Managerial efficiency covering the achievement of efficiency with the minimum use of resources.

Personal efficiency, a combination of knowledge, ability and the will to work. If these remarks are accepted it should be clear that the budget is of the greatest value in promoting managerial efficiency but the detailed financial steps that could be taken lie outside the scope of these comments.

Finance and Electricity Supply.

The provision of electricity has become a hall-mark of civilisation. The amount of electricity used is often the index by which the industrialisation of a country is measured and to a large extent the use by domestic consumers indicates the standard of living of the people. In view of its importance there is a strong economic necessity to keep the price as low as possible. The general financing of the electricity undertakings is quite properly a matter of public policy. The pricing

Die antwoord op die eerste vraag wat geopper is is dat dit voordelig is om die begroting te gebruik om doeltreffendheid te bevorder deur veral die bedryfsverhouding tussen inkomste en uitgawes te verbeter. Die klem word hoofsaaklik gelê op uitgawes, 'n deel waarvan buigbaar is in verhouding tot inkomste wat grotendeels buite die beheer van die Departement staan. Die sukses van die stelsel sou afhang van die mate waartoe die begroting diegene wat daarbinne werk gedurig gewus maak van die uitwerking wat hulle handelinge en besluite het op die finansiële werking van die Departement.

Aangaande die tweede vraag betreffende die praktiese perke waarbinne pogings aangewend kan word om doeltreffendheid te bewerkstellig, word die perke bepaal deur 'n ondersoek in die organisasie en bestuur van die onderneming. Organisasie word beskou as die struktuur of vorm van die besigheidssy van die onderneming, die vorm word so ontwerp dat die nodige ko-ordinasie van die afsonderlike funksies verkry word. Bestuur word beskou as die beherende invloed oor die organisasie wat die werking van die afsonderlike dele van die onderneming reguleer en die doeltreffende werking daarvan verseker.

Die begroting sal voorsiening maak vir die behoorlike toesig oor die praktiese perke in die bereiking van doeltreffendheid soos geopenbaar deur werkstudie metodes in verband met personeelaktiwiteite. Sorg moet gedra word by die vasstelling van hierdie praktiese perke om te verseker dat die personeel die werksmetodes begryp. Die ondervinding het geleer dat baie pogings om die beoogde doeltreffendheid te bereik misluk het vanweë die verontagsaming van die uitwerking wat veranderinge wat doeltreffendheid beoog op die personeel het.

Doeltreffendheid beteken verskillende dinge in verskillende nywerhede. Volgens sommige gesaghebbendes moet drie verskillende idees in verband met hierdie aangeleentheid onderskei word. Die eerste is doeltreffendheid of die mate van sukses waarmee die doelwit bereik word. Die tweede is besparing of die koste van doeltreffendheid in geld, mannekrag en materiaal. Die derde is doeltreffendheid self wat die verhouding tussen doelmatigheid en besparing is. Dis van geen voordeel vir die Departement dat die werk gedoen word sonder op die koste daarvan ag te slaan of dat onvoldoende geld beskikbaar gestel word om die werk op doeltreffende wyse te verrig nie. Die mikpunt van doeltreffendheid is om die beste van twee wêrelde te verkry en dis moeilik om te bereik.

Die idee van doeltreffendheid ontleed homself in drie dele. Tegniese doeltreffendheid wat die gebruik van masjienerie dek. Bestuursdoeltreffendheid wat die bereiking van doeltreffendheid met 'n minimum van hulpbronne dek.

Persoonlike doeltreffendheid — 'n kombinasie van kennis, bekwaamheid en die wil om te werk.

As hierdie opmerkings aanvaar word sal dit duidelik wees dat die begroting van die uiterste waarde is in die bevordering van bestuursdoeltreffendheid dog die nadere besonderhede van finansiële stappe wat gedoen kan word val buite die bestek van hierdie kommentaar.

Finansies en Elektrisiteitsvoorsiening.

Die verskaffing van elektrisiteit het die stempel van beskawing geword. Die hoeveelheid elektrisiteit wat gebruik word is dikwels die maatstaf waarmee die industriële ontwikkeling van 'n land gemeet word en tot 'n groot mate dui die huislike gebruik daarvan die lewensstandaard van 'n gemeenskap aan.

arrangements affect practically every citizen. The capital investment in electricity supply is a significant part of the total investment in the industry of the country.

However, the savings effected by the growth of efficiency in the technical and management sections of the undertakings can be offset by increased cost of materials, higher interest charges and increased cost of fuel. The three latter items are outside the control of management. Such financing as is required was to be recovered from the consumers by way of the electricity tariffs which on balance would tend to rise if an upward trend in costs of materials, interest charges and fuel is in operation.

It is a commonplace observation, observable through history, for the level of prices to rise. There have been, of course periods when prices fell, but observers have remarked, there is a strong trend, some even call it an historical law, for prices to rise, sometimes slowly, other times rapidly, but generally to rise, with the passage of time.

There has been a suggestion from some quarters that undertakings should carry sufficient reserves to provide a cushion against short term changes in demand and costs and to avoid the need for substantial or frequent alteration of tariffs. This is a principle to which support can be given. An extension of this idea of building up funds is that undertakings should find their capital requirements by internal finance which in effect is that present consumers should provide the capital requirements for future consumers. For an Electricity Supply Undertaking, doubling its size every ten years, to generate the whole of its capital requirements through prices would mean that revenue from consumers would have to be increased by a substantial amount, approximately 22 per cent per annum, to provide sufficient funds. It would be a bold man that would state that here is a clear principle that should be fully supported and override all other considerations. Conflicting points of view have to be met but there is considerable merit in the proposal and further investigations should be made.

Electricity supply has been termed a capital-intensive system and any proposal which tends to cut back capital is of considerable benefit to the industry by reason of the lower capital charges which would then have to be directly recovered from revenue.

The capital cost in electricity supply is high, the ratio of capital to revenue being two to one in distribution schemes compared with ratios of one to two or even four in some industries. Being highly capitalised the most intensive use is required to be made of the capital invested by limiting the cost of development without compromising efficiency or endangering the security of supply.

When the pressure on the total financial resources is too high, there is, rightly or wrongly, a criticism of the level of the Council's expenditure. This criticism rarely distinguishes investment expenditure from the rest. Evidence is available which indicates that price levels of commodities have risen over the 27 year period 1932—1959 by a percentage change of plus 322 per cent. The reference is found in an index of prices compiled by the London School of Economics. One is

Met die oog op sy belangrikheid is daar 'n sterk ekonomiese noodsaaklikheid om die prys daarvan so laag moontlik te hou. Die algemene finansiering van die elektrisiteitsonderneming is tereg 'n saak van openbare belang. Die prysvasstelling affekteer feitlik elke burger. Die kapitale belegging in elektrisiteitsvoorsieningsondernemings vorm 'n betekenisvolle gedeelte van die totale beleggings in die nywerhede van 'n land.

Besparings wat teweeggebring is deur verhoogde doeltreffendheid in die tegniese en bestuursafdelings van die onderneming kan egter verydel word deur die verhoogde koste van materiaal, hoër rentekoerse en die verhoogde koste van brandstof. Laasgenoemde drie items val buite die beheer van die bestuur. Finansies wat benodig word moet van verbruikers verhaal word by wyse van elektrisiteitstariewe wat 'n stygende neiging sal toon as die koste van materiaal, rentekoerse en brandstof aan styg is.

Dis 'n algemene geskiedkundige verskynsel dat pryse styg. Daar was natuurlik tye dat pryse gedaal het, dog waarnemers het opgemerk dat daar 'n sterk neiging, sommige noem dit selfs 'n geskiedkundige wet, bestaan vir pryse om somtyds stadig, somtyds vinniger, dog in die algemeen met verloop van tyd te styg.

Van sommige kante af het daar 'n voorstel gekom dat ondernemings voldoende reserwes behoort te dra om te dien as 'n buffer teen korttermyn skommelings in aanvraag en koste en die noodsaaklikheid van herhaalde of aansienlike tariefveranderinge te vermy. Dis 'n opvatting wat nogal steun verdien. 'n Uitbreiding van hierdie idee van fondse op te bou is dat ondernemings in hulle kapitaalbehoeftes moet voorsien deur interne finansiering wat in werklikheid beteken dat huidige verbruikers in die kapitale behoeftes van toekomstige verbruikers moet voorsien. Teneinde 'n elektrisiteitsvoorsieningsonderneming wat elke tien jaar verdubbel in grootte instaat te stel om sy hele kapitaalbehoeftes deur prysvasstelling te bekom, beteken dit dat inkomste van verbruikers afkomstig sal moet styg — sowat 22 persent per jaar — teneide voldoende fondse te verskaf. Dit sou 'n waaghals wees wat sal verklaar dat hierdie 'n duidelike beginsel is wat ten volle ondersteun behoort te word sonder enige ander oorwegings in aanmerking te neem. Teenstrydige menings sal teëgekom word dog die voorstel hou aansienlike voordele in en behoort verder ondersoek te word.

Elektrisiteitsvoorsiening is as 'n kapitaal-intensiewe stelsel bestempel en enige voorstel wat die besnoeiing van kapitaaluitgawe beoog is vir die nywerheid van aansienlike voordeel, gesien die laer kapitaalonkoste wat dan regstreeks van inkomste verhaal moet word.

Die kapitaalkoste verbonde aan elektrisiteitsvoorsiening is hoog — die verhouding van kapitaal tot inkomste is twee teen een in verspreidingskemas in vergelyking met verhoudings van een tot twee of selfs vier in sommige nywerhede. Aangesien dit so hoog gekapitaliseerd is moet die mees intensiewe gebruik gemaak word van belegde kapitaal deur die koste verbonde aan uitbreiding te beperk sonder om doeltreffendheid of die bestendigheid van die voorraad in gevaar te stel.

Wanneer druk op die totale geldmiddele te hoog is is daar, tereg of verkeerdelik, kritiek op die Raad se uitgawepeil. Hierdie kritiek onderskei selde of ooit tussen beleggingsuitgawes en ander uitgawes. Getuienis is beskikbaar wat aandui dat die pryspeil van goedere gedurende die 27 jarige tydperk

not bound to accept these figures as conclusive without further discussion or the presentation of further evidence but they are submitted to define a trend which is observable and definite which should be regarded fundamentally as a basis for dealing with criticism of increased costs in capital expenditure. The effects of increases in prices is difficult to forecast and for this and other reasons there appears to be a reluctance to adopt long term budgetting for capital expenditure as a general practice. Apart from prices there is also the universal difficulty of making reliable forecasts in real terms for several years ahead. Also allowance has to be made for monetary changes induced by variations in the economic structure of the country. It should be accepted however that broad approximations are necessary and possible on the assumption that these calculations have value as a guide in planning which is not destroyed by the inevitable lack of precision in the more distant years; Regular revisions can be made to the original plans to counter the variations in the value of money from time to time. It is recognised that it is virtually impossible to produce a long term plan of capital expenditure that would bring development to finality.

This is a subject which in my opinion merits attention and analysis and is one which could be discussed, with advantage, in greater detail at a future convention.

There is a risk that the remarks that have been made may have sounded either complacent or defensive. It is intended to be neither but rather to indicate that members of the Association are aware of the problems that beset them and realise how much remains to be done in managing an Electricity Department in these changing times.

Abraham Lincoln has said, in regard to taking action in dealing with these problems of change:—

"The dogmas of the quiet past are inadequate to the stormy present. The occasion is piled high with difficulty, and we must rise with the occasion. As our case is new, so we must think and act anew. We must disenthral ourselves."

I conclude this address with a very deep sense of appreciation of the honour you have conferred upon me, the City Council of East London and my colleagues in electing me President of the Association and wish to assure you that I will endeavour to further the aims and objects of our organisation with all the resources at my command.

1932–1959 gestyg het met 322 persent. Dit word gevind in 'n prysindeks wat opgestel is deur die London School of Economics. Mens hoef nie hierdie syfers sonder verdere bespreking of bewys as afdoende te aanvaar nie, dog hulle word slegs aangegee om 'n neiging te illustreer wat waarneembaar en definitief is en wat fundamenteel beskou moet word as 'n grondslag waarop kritiek op verhoogde koste in kapitaalbelegging behandel moet word. Die uitwerking van prysverhogings is moeilik om te voorspel en om hierdie en ander redes word daar skynbaar gehuiwer om langtermynbegrotings ten opsigte van kapitaaluitgawes as 'n algemene praktyk te aanvaar. Afgesien van pryse is daar ook die algemene probleem van betroubare voorspellings in reële terme vir etlike jare vooruit te doen. Daar moet rekening gehou word met skommeling in geldwaardes veroorsaak deur skommelings in die ekonomiese struktuur van die land. Ons moet egter aanvaar dat benaderings in breë trekke noodsaaklik en moontlik is as veronderstel word dat hierdie berekenings waarde het by beplanning wat nie verydel word deur die onvermydelike gebrek aan juistheid in voorspellings ten opsigte van die verdere toekoms nie. Die oorspronklike plan kan gereeld gewysig word om periodieke skommelings in geldwaardes teë te werk. Erken word dat dit feitlik onmoontlik is om 'n langetermyn plan vir kapitale uitgawes wat ontwikkeling sal finaliseer uit te werk.

Hierdie is 'n onderwerp wat myns insiens aandag en ontleding verdien en wat met voordeel in nadere besonderhede by toekomstige byeenkoms bespreek kan word.

Daar bestaan 'n gevaar dat die voorafgaande opmerkings òf selfvoldaan òf defensief mag klink. Dit word nie so bedoel nie maar eerder om aan te dui dat lede van die Vereniging bewus is van die probleme waarmee hulle te kampe het en besef hoe baie nog gedoen moet word om in hierdie wisselende tye 'n Elektrisiteitsdepartement te bestuur.

In verband met handelend op te tree teenoor hierdie veranderingsprobleme het Abraham Lincoln gesê: „The dogmas of the quiet past are inadequate to the stormy present. The occasion is piled high with difficulty and we must rise with the occasion. As our case is now, so we must think and act now. We must disenthral ourselves."

Ek sluit hierdie rede af met 'n baie diepe waardering vir die eer wat u bewys het aan my, die Stadsraad van Oos Londen en my kollegas deur my as Voorsitter van die Vereniging te verkies en ek wil u graag verseker dat ek sal trag om die doelstellings en mikpunte van ons organisasie met al die kragte tot my beskikking te bevorder.

Some Aspects of Electricity Supply Economics

By

HUGH H. SMITH, M.Comm., Ph.D., Professor of Commerce at Rhodes University

In this paper it has seemed wiser to deal in detail with certain aspects of electricity supply economics, rather than to attempt to cover the whole complex field of economics in relation to the generation and distribution of electricity. Broadly speaking, the paper can be divided into three sections. In the first section an attempt has been made to present some statistics relating to the supply and generation of electricity in the Republic, Southern Rhodesia and in Northern Rhodesia. In this section some indication will be given of the importance of the electricity supply and generating industry in comparison with certain other fields of economic activity and the structure of the industry will be examined. The relative importance of the municipally owned and operated electricity undertakings, on the one hand, and of the Electricity Supply Commission, on the other hand, will also be indicated. Section three will deal with certain financial aspects of electricity generating and distributing undertakings.

SECTION 1: THE GENERATION AND DISTRIBUTION OF ELECTRICITY AND ITS PLACE IN THE NATIONAL ECONOMY.

Before comparing the electricity generating and distributing industry with certain other fields of economic activity, it might be advantageous to examine the structure of the industry from certain points of view, and in Table 1 an attempt has been made to do this.

The non-municipal undertakings, of course, include the Electricity Supply Commission, but as this undertaking publishes its figures for each calendar year it is not possible to say what proportion of the non-municipal undertakings' figures in Table 1 are relative to the Electricity Supply Commission. On the basis of the figures given in the Commission's report for the year ended 31st December, 1959, however, it can safely be assumed that the overwhelming portion of the statistics for non-municipal undertakings given in Table 1 relate to the Electricity Supply Commission.

With the exception of the term "gross value of output", the terms used in Table 1 are quite straight-forward. Gross value of output is defined by the Department of Census and Statistics as being:—

> "The aggregate value of the goods manufactured and work done during the year by establishments classified under that industry."

It will be seen then that the municipal undertakings generate only approximately one-fifth of all the electricity generated in the Republic, but that they account for between 50 and 60% of the other heads in Table 1. This is obviously largely due to their distribution of the electricity purchased from the Electricity Supply Commission.

Tables 2, 3 and 4 shows various statistics for the generation and distribution of electricity compared with correspond-

TABLE 1.

Comparison of certain statistics relating to Municipal and Non-Municipal Electricity and Distributing undertakings in the Republic of South Africa in the year ended 31st March, 1959.

		Municipal	%	Non-Municipal	%	Total	%
Units Generated	000	4,172	21.3	15,489	78.7	19,661	100.00
Number of Persons employed		14,008	50.2	13,899	49.8	27,907	100.00
Cost of Materials used	R000's	37,986	63.1	22,198	36.9	60,184	100.00
Salaries and Wages paid	R000's	10,758	49.2	11,084	50.8	21,842	100.00
Gross Value of Output	R000's	76,288	53.6	65,760	46.4	142,048	100.00

SOURCE: Special Report No. 237 of the Department of Census and Statistics.

TABLE 2.

Statistics relating to the generation and distribution of electric light and power and also of certain other industries in the Republic of South Africa in the year ended 31st March, 1959.

		Electric Light and Power	Manufacturing	Construction
Value of gross output		142,048	2,421,262	269,004
Cost of materials used	R'000	60,184	1,451,890	154,604
Salaries and wages paid	R'000	21,842	475,978	74,882
Number of persons employed		27,907	632,168	118,845

SOURCE: Special Report No. 237 of the Department of Census and Statistics.

ing figures for other sectors of the economy. The difficulty here has been to obtain figures for other sectors of the economy. These tables are largely self-evident and there is no need to spend time in commenting upon them.

Table 5 shows the contribution of various sectors to the national income of the Republic in the 1958/9 census year. The national income of a country may be defined as the payments made to the economic factors of production, *viz.*, labour and

TABLE 3.

Statistics relating to the generation and distribution of electric light and power and also of certain other industries in Southern Rhodesia in the 1958/59 census year.

	Electric Light and Power	Mining and Quar.	Manufacturing	Construction
Gross output ..... R000's	18,264	52,798	241,134	124,156
Cost of materials and fuel used R000's	6,702	17,752	141,720	49,428
Salaries and wages paid ..... R000's	4,426	15,994	49,492	36,562
Number of persons employed	5,608	50,533	85,315	70,279

SOURCE: The Census of Production of the Federation of Rhodesia and Nyasaland 1958-59.

TABLE 4.

Statistics relating to the generation and distribution of electric light and power and also of certain other industries in Northern Rhodesia in the 1958/59 census year.

	Electric Light and Power	Mining and Quar.	Manufacturing	Construction
Gross output .... R'000	18,572	220,008	38,678	50,988
Cost of materials and fuel used R'000	9,680	43,782	21,050	23,476
Salaries and wages paid ..... R'000	1,040	47,944	8,850	18,962
Number of persons employed	1,012	45,515	16,565	12,217

SOURCE: The Census of Production of the Federation of Rhodesia and Nyasaland 1958-59.

TABLE 5.

Summary of the national income of the Republic of South Africa in the 1958/59 census year.

Head	Total R Million	Salaries and Wages R million	Other R Million
Agriculture, Forestry and Fishing	472.8	139.0	333.8
Mining	540.4	242.2	298.2
Private manufacturing	997.8	646.4	351.4
Trade	477.6	305.2	172.4
Transportation	328.6	268.4	60.2
Miscellaneous Business:			
Union Government	67.4	50.0	17.4
Municipalities	59.4	30.6	28.8
Other Public	48.6	23.0	25.6
Private	74.6	29.8	44.8
Public Authorities	425.0	379.0	46.0
Private Households	117.8	117.8	—
Other	444.0	177.8	266.2
Total Geographical National Income	4,054.0	2,409.2	1,644.8
Less amount accruing to non-S.A. Factors	457.4	47.8	409.6
Net National Income	3,596.6	2,361.4	1,235.2

SOURCE: Union Statistics for Fifty Years", Pages 54 and 55.

capital. Labour's share of the national income consists of cash salaries andwages including payments in kind and employers' contributions to pension or provident funds and medical funds. The problem here is to isolate figures relating specifically to the generation and supply of electricity as these are not given separately. It can be noted, however, that the figures given under heading of "Miscellaneous business: municipalities: salaries and wages" includes at least R10.8 million representing the salaries and wages paid by the municipally owned and operated electricity generating and distributing undertakings. Similarly the salaries and wages given under the heading "Miscellaneous Business: other public" includes the salaries and wages paid by the Electricity Supply Commission. It is not possible to give a definite figure here, but again it probably matches the salaries and wages paid by the Municipalities.

The division of the generation and distribution of electricity between the Electricity Supply Commission, on the one hand, and the Municipalities, on the other hand, together with some generation and distribution being in private hands, naturally prompts the question as to whether it would not be advantageous from the point of view of the community as a whole for the generation and distribution of electricity in the Republic to be centralised in the hands of one authority. It is obvious that there would be advantages and disadvantages in taking such a step, and because these advantages are not necessarily mutually exclusive, the concentration of the generation and distribution of electricity in the hands of a single authority would be a step fraught with much controversy. Perhaps the best way of clearing the ground somewhat would be to examine some of the advantages and disadvantages which might be expected to result from such a concentration.

Taking the advantages first, it could be anticipated that some or all of the following advantages might occur as the result of the concentration of the generation and distribution of electrivity in the hands of one authority.

(a) In the first place, it would be possible to derive the benefits which flow from the increase in the size of undertakings. (As these benefits are complicated, instead of indicating them in detail here, it has been decided to defer them until later in this paper). The electricity generating and distribution industry is one in which the optimum size of the undertaking is large and where this is the case it would seem to be better to have a lesser number of large undertakings, than a larger number of small undertakings each of which operating in limited area cannot obtain sufficient demand for electricity to justify its expansion to optimum size.

(b) There must be a number of electricity generating and distributing undertakings, particularly the smaller ones, which are operating with out-of-date equipment and which cannot provide a service giving maximum efficiency to the consumers. A single generating and distributing authority for the whole of the Republic would be able to close down those undertakings which are not up to the required standard of efficiency, and to supply the areas concerned from strategically situated large generating undertakings.

(c) Another aspect of this same advantage is that with a number of generating and distributing undertakings of unequal size and efficiency, there is likely to be over-supply in certain areas, at the same time as there is under-supply of electricity in other areas. One central authority could operate a system by which power stations could be operated at a more uniformly high level of activity and electricity transfered from one area to another to meet differ levels of demand.

(d) Without greater investigation, it is not possible to say if in fact there is duplication of effort, equipment and labour under the present system of electricity generation and distribution in the Republic, but with one centralised electricity generating and distributing authority the possibility of such duplication could be avoided.

(e) One centralised authority should be able to plan its activities and its expansion more effectively than a number of independent undertakings, and so be of greater benefit to the economy of the Republic as a whole. Such a body would also be in a better position to undertake the research necessary for the solution of the problems confronting the industry and to devote research to the developments of new methods and techniques. Such a body might well also be in a position to train its employees more effectively for the specialised duties which have to be performed in the electricity generating and distributing industry.

(f) It might be possible for such a centralised authority to provide electricity at a uniform tariff throughout the Republic, though the writer has insufficient knowledge of the industry to say whether he considers this might be possible or not. If it were possible, it might assist to some extent in the decentralisation of industry since it would seem logical that at present those undertakings located in areas of greater population (e.g., the Southern Transvaal, the Western Cape) can supply electricity at a lower rate than those in the less densely populated areas. The cost of electricity may be a factor of some importance to an industrialist in deciding upon a location for his industry, though proximity to the market or to the raw materials may be of greater importance.

On the other hand, there will almost certainly be disadvantages associated with the centralisation of the generation and distribution of electricity in the hands of a single authority. Some possible disadvantages are listed below.

(a) It is all too common experience to find that when an undertaking is in a monopolistic position (i.e. the sole supplier of a service to a whole country), it lacks the will be maintain maximum efficiency and not only do inefficiencies manifest themselves, but "red tape" or beaurocracy detract from the benefits which should be achieved by such an undertaking.

(b) Although it is in the nature of things for electricity generating and distributing undertakings to be granted a considerable degree of monopoly in their field, one centralised authority would be even more strongly entrenched in such a position. Such an undertaking, in the absence of suitable safeguards, would be in a position arbitrarily to impose its tariffs on the community. It should be noted in this connection that much of the

opposition to the South African Railways, which occupies a position similar to that which would be occupied by a centralised electricity authority, originates not in the principles upon which it bases its rating policy, but in the fact that it is in a position arbitrarily to determine tariffs and that no appeal machinery exists against the decisions of the Administration.

(c) It is possible that one centralised electricity authority might override the legitimate interests or desires of a particular region or area.

(d) Such a centralised authority could become the tool of political interests to a much greater extent than a number of smaller undertakings, and efficiency might be sacrificed to political expediency.

This whole problem is extremely complex and it is almost impossible to give a definite conclusion as to whether the present structure of the electricity generating and distributing industry should be maintained, or whether it should be completely centralised. Much will depend upon the powers which would be given to such a centralised authority. It might, for example, be given complete control of all the activities connected with the generation and distribution of electricity, or it could be given only advisory and consultative powers with the aim of improving co-ordination and planning. Another matter to be considered is whether there should be a complete organic union of all generating and distributing undertakings, or only some loose association. In any event it seems from a point of view of planning and co-ordination that some measure of integration of the generation and distribution of electricity would be beneficial, but the writer would not venture to presume to express an opinion either as to how far this integration should be carried or how it should be accomplished.

A cognate matter here is the part which electricity has played in the expansion of the Republic's activity, say, since the end of the second world war. There is no doubt that there has been a most significant expansion in the economic activity of the Republic in the last twenty-years, but it is difficult to obtain figures which indicate accurately the magnitude of this expansion. Such figures as are available tend to be distorted by the rising wage level, rising prices or the fall in the purchasing power of money and so do not give a true picture of the physical expansion of the Republic's economic activity. The following figures show the number of KWH sold by all power stations in the Republic for mining and for industrial purposes in the 1945/6 and 1958/9 census years:

It is obvious that electricity must play an increasingly important part in an expanding industrial economy and therefore any economic planning must take into account the need for the provision of adequate supplies of this essential commodity. This involves making decisions about the establishment and location of new power stations, the expansion of existing power stations and the provision of reticulation facilities so that new areas can be provided with the opportunity to use electricity as a source of power, fuel and lighting. This seems to involve two aspects: what might perhaps be termed an extensive phase in which facilities are provided for new consumers, and an intensive phase in which existing consumers are induced to make more use of existing facilities.

The whole question of economic planning is an extremely complex one, and much of the difficulty arises from the formidable number of variables involved. It is not sufficient simply to say that it is expected that the level of economic activity will increase: the planners must attempt to give a quantitative forecast of future levels of economic activity. It is also necessary to give some indication of the areas in which the expected economic activity is likely to take place, for there is no point in providing increased facilities for, say, the supply of electricity in one area only to find that expansion has taken place in another area.

All this means that the planners must have some idea of the trend of growth of all the sectors of a country's economy, and also whether there will be available the capital funds necessary to finance the increased economic activity. This in turn will mean that the question of spending and saving by persons will have to be considered and also the effect of changes in demand by consumers, using this word in its broadest sense and not restricting it to the ultimate consumers of consumer goods.

Finally, because the economy of a country is dynamic and not static, changes can occur which will upset the plans of forecasters so that what actually happens may be greater or less than the planners anticipated. To a considerable extent, too, these changes are unpredictable in advance. Nevertheless, some attempt at economic planning is essential on a national, regional and local scale. It is probably true to say that any economic planning is better than no planning at all, even if the plans have to be revised in the light of future events.

SECTION II: SOME ECONOMIC CONCEPTS

In their analysis of economic problems, economists make use of various concepts and it has been suggested that, as these are not always familiar to the non-economist, some simple explanation of certain of these might be valuable. Perhaps the most fundamental of these concepts is that of supply and demand and the effect of changes in supply and

Year	Electricity in KWH sold for Industrial Purposes	Mining Purposes	Total KWH sold
1945/46 census year	1,419.0	3,796.5	7,338.3
1958/59 census year	4,958.3	8,991.1	19,106.2
Percentage increase	249.0	136.5	160.5

demand on the price of the commodity or service in question. Supply is depicted graphically as a curve sloping upwards to the right thus indicating that under given conditions the suppliers of the particular commodity or service will be prepared to put increasing quantities on the market as the price increases. Demand is depicted graphically as a curve sloping downwards to the right, thus indicating that the consumers of the commodity or service will be prepared to purchase more as the price falls.

From this supply and demand curve mechanism it is possible to see what is likely to happen in the event of there being such changes in the fundamental conditions underlying these curves as to move them either to the right or to the left. It is possible, for example, for a change in such factors as for example consumer preferences or vagaries of the weather, to change the position of the demand curve of or the supply curve for a commodity. If there is an increase in supply while demand remains unchanged, there will be a fall in the equilibrium price, i.e., the price at which the quantity supplied will be taken off the market with those given demand conditions. Conversely, if there is a decrease in supply while demand remains unchanged, then the new equilibrium price will be higher than the previous equilibrium price. A change in the position of the demand curve, while supply remains unchanged, will have a similar effect, but in the opposite directions. It should be noted that in course of time the higher price resulting from a decreased supply or an increased demand will tend to encourage new entrepreneurs to enter the industry and so increase the supply with a resultant fall in price. In the same way an increased supply or a decreased demand will tend to discourage entrepreneurs from entering that particular industry and will encourage some of the existing entrepreneurs to leave it and so supply will decrease and the price will tend to rise. The time it takes for such an adjustment to become effective varies — in some cases it may be possible to curtail supply almost immediately, whereas in agriculture for example increasing or decreasing the supply may take a considerable length of time. A curious feature about agriculture is that a fall in price may actually lead to an increase in supply, as each producer attempts to ensure that he will receive the same income as before even though prices have fallen. The net result of such a procedure is, of course, to drive prices down still further. Finally, we might note that the demand curve and the supply curve might both change their positions at the same time.

Much of the economist's analysis is concerned with prices in an attempt to find out both how prices come to be what they are and to what extent actual prices represent an ideal situation from the point of view of the economy as a whole. Among various functions, prices serve the purpose of distributing a limited supply of commodities or services among consumers. There are those consumers who want the commodities or services so intensly that, provided they have the financial resources available, they are willing to pay higher prices than other consumers. Those consumers for whom the prices are too high in relation to their estimate of the value of the commodity or service to them, and in relation to their financial resources, have either to go without the commodity or purchase a substitute at a lower price. Among commodities and services we find the factors and production — land, labour and capital — and the pricing system distributes these productive resources among competing demands. The various sectors of the economy (e.g., the State, local government, industry, distribution, etc.) compete for these resources, and different entrepreneurs in the same economic sector compete for the resources available to the sector as a whole. Those entrepreneurs who can offer the highest prices for these factors of production are able to supply their requirements from the resources available, while industries who cannot pay the prices because they are too high to enable the entrepreneur to make a satisfactory profit are forced to limit their activities. The prices of these factor of production are represented in the case of land by its rent or price, in the case of labour by wages and in the case of capital by interest or dividends. It must be noted that, in practice, pricing may not be accurate as the theory represents it to be and it is possible for a maldistribution of commodities, services and resources to occur.

It is also necessary to consider briefly the concept of elasticity, as it applies to both supply and demand. Elasticity measures the rate of response of supply and demand to small changes in price. The elasticity of demand for a commodity or service is the rate at which the quantity bought changes as the price changes, other things remaining the same. (It will be recognised that this, therefore, determines the steepness of the supply of the demand curve.) The elasticity of supply of a commodity is the rate at which the quantity offered for sale changes as price changes, other things remaining the same. These definitions are easier to understand in terms of the following simple formulae:—

$$\text{Elasticity of demand} = \frac{\text{Percentage change in quantity bought}}{\text{Percentage change in price}}$$

$$\text{Elasticity of supply} = \frac{\text{Percentage change in quantity offered}}{\text{Percentage change in price}}$$

As Cairncross says:—

> "The elasticity of demand measures the ease with which people can put up with a small reduction in their consumption, or alternatively, the ease with which they can be induced, by a reduction in price, to consume a little more of it. If people buy the same amount of a commodity irrespective of the price, *i.e.*, if they cannot do without *any* of the amount which they are buying then demand is absolutely inelastic (elasticity is equal to zero). If people cease to buy the commodity altogether when it rises slightly in price, then demand is perfectly elastic (elasticity is equal to infinity). These are the outer limits. Within these limits we can distinguish between demands that change more rapidly, and demands that change less rapidly than price. Just on the dividing line, a given change in price will lead to an exactly proportionate change in the quantity bought; elasticity of demand is then equal to unity. On one side of the line, elasticity will be greater, and, on the other side, less than unity. When elasticity is greater than unity — that is, when a

given change in price leads to a more than proportionate change in demand — we say that demand is *elastic.*

When elasticity is less than unity — that is, when a given change in price leads to a more than proportionate change in demand — we say that demand is **elastic.** When elasticiay is less than unity — that is, when a given change in price leads to a less than proportionate change in demand — we say that demand is **inelastic** it will be observed that elesticity is a matter of degree, and that even when demand is inelastic, there are still some elements of elesticity"(1).

Ahe concept of elasticity of demand is of greater importance, especially for such suppliers of public utility services as electricity undertakings. Suppose such an undertaking is thinking of increasing its rates, one of the first questions which will have to be considered will be how much revenue will be lost. With an increase in the price of electricity, some consumers will reduce the quantity of electricity which they consume, while in certain circumstances, some consumers may give up purchasing electricity completely. An increase in the price of electricity to the consumer may therefore not bring in as much increased revenue as anticipated. To a certain extent this can be overcome by increasing the tariffs of those consumers whose demand for electricity is inelastic — in other words an increase in price will lead to a less than proportionate fall in the quantity demanded. Conversely, if tariff reductions are being contemplated, they will be given to those consumers whose demand is elastic because here a fall in price will be followed to a more than proportionate increase in the quantity purchased.

The elasticity of demand for a commodity depends to a considerable extent on the range of substitutes available. The wider the range of substitutes available, the more elastic will be the demand for any commodity or service. If electricity in East London, for example, becomes dearer the demand for electricity may not decrease very much because it is unlikely that many people will consider either a paraffin stove or a coal stove a very satisfactory substitute for an electric stove. If, however, gas is freely available this may be considered a very satisfactory substitute method of cooking and heating and an electricity undertaking would have to be much more circumspect in the latter than in the former case. It is also true that a commodity which has several alternative uses, generally has an elastic demand; and a necessity has a less elastic demand than a novelty or non-essential commodity. It should also be noted that the response of consumers and producers to a change in price is generally spread over a period of time, though in some cases the reaction may be immediate. It is quite possible to find a situation in which, in the short run, consumers may have no alternative but to pay higher prices; but in the long run the range of alternatives may increase and substitution become easier. If railway goods rates go up there may be no immediate reduction in traffic carried, but a great many businesses will begin, other things being equal, to seek alternative forms of transport.

It would be misleading if the foregoing created the impression that it is easy to calculate precisely the elasticity of a commodity or to draw up demand and supply schedules and so draw demand and supply curves. In neither case is this true and the demand-supply curve as a tool of economic analysis is open to many criticisms and weaknesses, but it is nevertheless a necessary foundation upon which to erect the higher structures of economic analysis.

(1) Cairncross: Introduction to Economics: pp. 227—8.

Two other concepts which are frequently used by economists are marginal cost and average cost. It will be recognised that cost is an important determinant of the quantity which will be supplied and cost determines supply in two ways. In the first place it controls the volume of output which each firm finds it profitable to produce, and in the second place it controls the number of firms that can carry on operations at a profit. (In both cases, of course, cost will be considered in relation to either the prices ruling in the market or in relation to the price which the entrepreneur anticipates he will be able to obtain.) If the costs of producing a commodity rise, *other things remaining the same,* the supply will contract of a double reason: firstly, each firm will discontinue manufacturing units of output that no longer pay their way; and secondly, some firms will find it necessary or advantageous to abandon production of the commodity altogether. The rise in costs is said, therefore, to affect supply at the *margin, i.e.,* on units of output which it is just worth while for each firm to produce, and on firms which previously had just found it profitable to produce. From this argument, the economist says, and says correctly, that it is the marginal, rather than the average, cost which controls the quantity which will be supplied. *Marginal cost* is defined as *the net cost of a marginal addition to output,* and from the point of view of an individual undertaking it means the cost of increasing its output by a single unit, as shown in Table 6.

The average cost to a firm is simply the total cost of producing a certain output divided by that output.

The marginal costs and the average costs of a firm can be depicted diagramatically and when this is done it is seen that the marginal cost curve behaves in a peculiar manner in relation to the average cost curve. The marginal cost curve is at first below average cost. Eventually, the marginal cost curve begins to rise, but as long as it remains below the average cost curve (*i.e.*, so long as each additional unit costs less to produce than the average cost of producing that quantity), the average cost curve continues to fall. When marginal cost is exactly equal to average cost, the average cost curve is at its lowest point and is neither rising nor falling. Thus the marginal cost curve intersects the average cost curve at the latter's minimum point. When marginal cost exceeds average cost (i.e., when each additional unit costs more to produce than the average cost of producing that quantity), average cost is rising but less steeply than marginal cost.

Analagous to marginal cost and average cost are *marginal revenue* and *average revenue.* Marginal revenue is the revenue derived from the sale of one additional unit, while average revenue is the total revenue derived from the sale of a certain quantity divided by that quantity.

The importance of these concepts in economic analysis is that they are used by economists to show how the most profitable output of a firm can be determined. The most profitable output for a firm is that given by the point of intersection

of the marginal cost curve and the marginal revenue curve. Economists distinguish various conditions of markets, the first of these being termed the condition of perfect competition. This, briefly, is a market condition in which no firm can, by its own actions, affect the price at which its product is sold and it can sell as much or as little as it produces but only at the ruling market price. Under such conditions average revenue and marginal revenue are equal and take the form of a horizontal straight line. Using the above principles, a diagram will be drawn on a blackboard illustrating the determination of a firm's most profitable output under these market conditions. In the example on the board it will be seen that at the point of intersection of marginal cost and marginal revenue, average cost is also equal to average revenue. This means that the average cost of producing that output and the average revenue derived from its sale are equal. If the ruling market price were higher, the intersection of marginal cost and marginal revenue would be higher and the firm would be making an abnormal profit. On the other hand, if the price were to be lower, it would not be profitable for the firm to continue in production.

The second market condition is that of monopoly — *i.e.*, there is one producer who, it is postulated, is the sole supplier of the commodity. Such a producer is able to set his price at any level which he chooses, and he can decide whether to sell a smaller quantity at a higher price or a larger quantity at a lower price. As before, however, the most profitable output is given by the intersection of the marginal cost curve and the marginal revenue curve. The only difference in the analysis is that in monopoly conditions marginal revenue is not equal to average revenue, but the former is always below the latter. In the example to be worked on the blackboard, it will be seen that the application of the principles outlined above gives the most profitable output and at that quantity there occur what are termed abnormal profits. This is a profit additional to that which, being included in the cost curve, is just sufficient to induce the firm to remain in business. Under monopoly conditions it is possible for these abnormal profits to be maintained as long as the monopoly of supply can be maintained. On the whole, while perfect competition, though rare, does exist, perfect monopoly does not exist. It *could* exist in the case of an electricity supply undertaking, for example, which had the sole right to supply electric light and power to a particular area, in which no substitutes for electricity existed, and where the supply undertaking had the absolute right to fix prices. It will be recognised that such a conjunction of factors is virtually impossible to achieve in practice. A much more likely situation in the market is that of monopolistic competition, *i.e.*, a situation in which each firm is faced by a certain amount of competition but in which each firm also has something tangible or intangible which differentiates its product from that of its competitors. The determination of the most profitable output of a firm in such a market condition is the same as that under perfect monopoly, but since firms can freely enter the industry, in the long run any abnormal profits the existing firms were making will be reduced by competition until an equilibrium situation is reached where each firm is only making the normal profits included in the costs which determine the position and shape of the average cost and the marginal cost curves.

In our earlier discussion of the position of a monopolist it was suggested that he could sell either at a higher or a lower price, but that his profit would be maximised when he sold at the price indicated by the intersection of the marginal revenue and the marginal cost curves. Some monopolists, however, are able to divide their sales among a number of different "markets" and to charge a different price in each market. This is known as *discrimination* and it is possible for electricity distribution undertakings to practise such a policy. The electricity undertaking can charge different groups of con-

TABLE 6.

Cost Schedule of a Small Factory.

Output in Units	Total Fixed Costs R	Total Variable Costs R	Total Cost R	Average Total Cost Per Unit Produced R	Marginal Cost R
1	32.00	7.20	39.20	39.20	—
2	32.00	12.90	44.90	22.45	5.70
3	32.00	17.40	49.40	16.47	4.50
4	32.00	21.00	53.00	13.25	3.60
5	32.00	24.00	56.00	11.20	3.00
6	32.00	26.70	58.70	9.78	2.70
7	32.00	29.40	61.40	8.77	2.70
8	32.00	32.40	64.40	8.05	3.00
9	32.00	36.00	68.00	7.55	3.60
10	32.00	40.50	72.50	7.25	4.50
11	32.00	46.20	78.20	7.10	5.70
12	32.00	53.40	85.40	7.12	7.20
13	32.00	62.40	94.40	7.26	9.00
14	32.00	73.50	105.50	7.53	11.10
15	32.00	87.00	119.00	7.93	13.50

sumers different prices for the electricity which they consume, and/or they can charge different prices for electricity when it is used for different purposes. In this respect electricity undertakings are generally in a different position from other commercial and industrial undertakings.

All the units sold at one price are said to be sold in one "market" so that a discriminating monopolist has as many markets as he charges different prices. Discriminating monopoly is possible only if the goods or services sold in the cheaper market (*i.e.*, at the lower price) cannot readily be transferred to the dearer market. It is this which prevents most commercial and industrial firms from practising such a scheme —it would, for instance, be impossible to charge higher prices to well-dressed customers for people could easily dress shabbily or get others to make their purchases for them. In the case of the electricity undertaking, however, a householder cannot represent himself to be a factory-owner, and separate meters prevent current charged at a lower rate for power purposes being used for lighting.

The importance of all this is that where a monopolist can divide his sales among a number of markets, between which conditions of demand are different, he will make greater total profits by charging a different price in each market. In the economist's terms: "he will maximise his profits by charging such prices that his marginal costs (for his total output) are equal to the marginal revenue in each separate market." When this is done, the monopolist will gain neither by increasing nor decreasing his output, nor yet by transferring some sales from one market to another. Lastly, it should be noted that discrimination is profitable only if the elasticity of demand is different in each market, the most profitable price being lower in the market where the elasticity of demand is greater.

It will be common knowledge to you, Gentlemen, that the costs of an undertaking can be divided into those which are fixed, in that they do not vary with changes in the level of output or activity, and into those which do vary with these changes. In electricity undertakings, in common with other public utility undertakings, fixed costs are large because these undertakings require a large amount of specialised equipment and plant. Electricity generating and distributing undertakings, it has been shown, are usually monopolists and frequently they can discriminate in the prices which they charge. Another point about a public utility undertaking is that it may well find that at times it has to operate at less than full capacity. One reason for this is that it is frequently cheaper for such an undertaking to build a power station, or provide distribution facilities, in excess of those needed at a certain time as this is cheaper in the long run than making successive alterations. Likewise, if an extension is to made to cope with say 10% increase in demand for the service, it frequently pays the undertaking to increase facilities to cope with a greater demand than that existing at the time the expansion is made. Again, it may be cheaper to produce electricity from a larger plant working at less than full capacity than from a smaller one operating a full capacity.

Another reason for excess capacity in public utilities is that demand fluctuates over time, and unless the product can be stored one has to have a plant large enough to cater for the "peak" demand. This obviously means that excess capacity will be present when demand is below the peak level. By means of advertising and other propaganda methods it may be possible to raise the demand during off-peak periods, and to reduce it during the peak periods if that strains the capacity of the plant and raises marginal costs sharply. A more effective method of doing this may be to charge a much higher rate per unit of electricity for current consumed during the peak demand period.

Now another factor to be considered in this case is that variable costs are unlikely to be rising if the plant and equipment are being worked below full capacity. Hence to charge a price per unt which is equal to the marginal cost would cover only a part of total costs for it would fail to cover fixed costs. There are two methods open to an undertaking in such a case. Firstly, it could charge a price per unit which is equal to average total cost. This, however, would usually be much higher than marginal cost, and it is in the social interest to meet the potential demand of consumers who are prepared to pay prices for extra units which cover the extra cost of supplying those units.

The second possible method open to an electricity undertaking in such a case is the use of what is called a *two-part tariff*. Under such a system of charging, the consumer has to pay two charges. The first is a fixed charge which does not vary with consumption. This charge must be paid whether much or little is consumed, or none at all of the service used. All the fixed charges, taken together, would approximately cover the fixed costs of the undertaking. The second part of the charge is a charge per unit of electricity consumed, and sometimes this is at a decreasing rate per unit as various increased quantities are consumed. This second part of the charge covers the marginal costs of the undertaking.

After this somewhat extensive analysis of these concepts, the question arises as to the extent to which an ordinary business firm uses or can use the marginal cost-marginal revenue mechanism. On this subject, Cairncross says:—

> "Many business men, comparing the logic of the foregoing argument with their everyday experience, would be inclined to dismiss the argument as academic. Few of them have heard either of marginal cost or of marginal revenue. Only a proportion of them have the costing machinery necessary for the estimation of average, still fewer for the estimation of marginal cost. Even if costing were in universal use, it would in many industries be extremely difficult to apply it to the estimation of marginal cost, while marginal revenue must almost always be a matter of guesswork. In many industries the usual procedure is to fix a price on the basis of average direct costs in labour and materials plus an allowance for overheads. This allowance is worked out so as to cover averaged fixed costs, not at the capacity level of output at which the plant was designed to operate, but at a rather lower level . . . which takes into account fluctuations in activity and is treated as normal or standard for the purpose of costing. Sometimes the procedure is less elaborate: retail prices, for example, are often arrived at by adding a customary percentage margin to the wholesale price, irrespective of the actual selling costs; and in manufacturing industry, firms may use a similar method, adding a uniform per-

centage mark-up above direct costs for a wide variety of products without any accurate assessment of the fixed costs attributable to each.

Both of these procedures are usually referred to as 'full-cost pricing' and they are frequently cited as evidence of the disdain with which economists treat the elementary facts of business life. The economist on the other hand is sceptical about the 'facts' because they carry the logical implication that the business man, almost as a matter of principle, charges less than he might. The way to make as big a profit as possible is to charge, not on the basis of cost, but what the market will bear; this means varying the price with *demand* on the one hand and *marginal* cost on the other, not deliberately ignoring both. How are we to reconcile the logic and the apparent facts?

Various considerations suggest that the business man may not be so illogical not the economist so inobservant after all. The behaviour of prices and costs differ from one market to another, and what is true in one market is not true in another. It would be a mistake, therefore, to think that the few propositions outlined above provide an adequate clue to the complexities of cost and market structure throughout industry; but they take us a little way along the road."(2)

Finally, in this section attention might be directed to one further concept, *viz.* the law of diminishing returns, which deals with the substitution of one factor of production for another. It must be noted firstly that there are two general principles governing the substitution of one factor of production for another. The first of these principles is that no one factor of production is a perfect substitute for another, for if they were we would not have the separate factors of land, labour and capital, but only one general factor of production. The second principle is that substitution becomes progressively more difficult the more it is attempted to substitute one factor for another. It is easy to do without a little of one factor and use a little more of another, it is difficult to do without a great deal of one factor and replace it with another.

From these two principles it is possible to derive the law of diminishing returns which is simply a statement that, sooner or later, other things remaining the same, the combination of an increasing number of units of one factor with a given number of units of other factors must lead to a less than proportionate increase in output. The total output increases, but it does not increase as rapidly as the variable factor is increased. The reason for this is simply that some factors are not increased at the same time as the variable factor, and the increased supplies of the variable factor cannot entirely make up for the deficiency unless the variable factor and the fixed factor are perfect substitutes one for another. This is illustrated in the following table.

The first three columns are purely hypothetical, and are inserted to make it possible to derive columns 4 and 5. If column 4 is increasing as output increases, the increase in output is more than in proportion to the increase in A; and if column 4 is decreasing, the increase in output is less than in proportion to the increase in A. A third situation is also possible, intermediate between the other two, at which output increases exactly in proportion to the increase in A, so that for a time column 4 remains constant. In such a situation we have constant returns.

In the hypothetical table it is after 6 units of A have been combined with 10 units of B that diminishing returns begin to operate. A question which arises is why it is always necessary to combine the variable units of A with 10 units of B; why, for example one should not combine 3 units of A with 5 units of B and so produce half the output given by 6 units of A and 10 units of B. The possibility of doing this will depend upon whether B is divisible into smaller units or not. If B is indivisible, in the sense that it cannot be duplicated on a smaller scale, it will not be possible to take a smaller number of units of it. It will then be necessary to combine the 10 units with a smaller number of units of the factor which is divisible, even though this produces a lesser number of units of output than would seem to be ideal. It is also of little use

(2) Cairncross: op. ait. pp. 265—7.

TABLE 7.

Variations in Factor Proportions.

Units of A (1)	Units of B (2)	Units of Product (3)	Average Product per Unit of A (4)	Average Cost of Production in Rand (5)
1	10	50	50	2.40
2	10	200	100	.70
3	10	600	200	.27
4	10	960	240	.19
5	10	1,270	254	.16
6	10	1,530	255	.144
7	10	1,750	250	.137
8	10	1,920	240	.136
9	10	2,070	230	.135
10	10	2,200	220	.136

Note: Column 5 is based on an assumption that one unit of A costs R20.00 and one unit of B costs R10.00.

producing 1,530 units of output, just because it appears to be the most favourable point of production, if there is no market for this number of units. A small power station, for example, may have half the capital of a large one and yet, employing more than half the labour force of a larger station, it may produce less than half as many units of electricity. It is not much use to recommend the smaller station to adopt the methods of the larger ones, and turn itself into a kind of half-size replica, for it is only undertakings which are of a certain minimum size which can avail themselves of certain methods of large-scale production. Nor is it sensible to recommend the small power station to double its output and become a full-size replica of the large station if the increased output cannot be sold.

In reality it will probably seldom be found that all factors are perfectly substituteable or that all factors are equally scarce. It will probably be found that the supply of certain factors are more limited than that of others. This means that it will be more costly to use units of the scarcer factor, or second-rate units of it will have to be used, while the other factor can be obtained in comparative abundance, and so the tendency will be to substitute the more abundant factor for the scarcer. If such substitution were impossible and the factors had to be combined in a fixed proportion, costs would rise steeply. In practice some degree of substitution will be practised, but because of the law of diminishing returns substitution will be imperfect and costs will rise eventually, though at a considerably higher output than the output at which returns begin to diminish. (See Table 7.) Thus it is because industries are forced to make do with the factors of which they can make increased use, meeting the deficiency of other factors in the best way possible, that diminishing returns come into play. Using a larger proportion of the factor which can be most easily increased is simply a method of economising the other factors and avoiding the consequences of their scarcity.

I would now like to deal briefly with the question of economies of scale. This term is used to indicate that as an undertaking increases in size there are various economies which accrue simply because the firm is large in size. These economies are usually grouped into five sections as the following analysis will show.

In the first instance it is possible to distinguish what are called the **technical** economies of scale. These technical economies are of four kinds.

(a) **The economies of superior technique:** many types of machinery cannot be reproduced at all on a smaller scale, so that a small undertaking either has to instal machinery which it cannot keep continuously in operation or it has to do the best it can with less efficient machinery of a different type.

(b) **The economies of increased dimentions:** even when a machine can be duplicated on a smaller scale, there is often an advantage in using the larger machine as, for example, when the increase in size results in a less than proportionate loss by friction, evaporation or cooling. Furthermore, in spite of its greater output, a large machine can often be operated by a team of workmen no larger than that required to operate a smaller one of the same type. Not only is a larger machine cheaper to operate in many instances, but it is often proportionately cheaper to construct so that, for example, an electric motor developing 20 horsepower is not twice as expensive as one developing 10 horsepower. It should be noted, however, that large mechanical units are not **necessarily** more efficient than smaller ones: it depends upon what dimensions are being increased.

(c) **Economies of increased specialisation:** in large undertakings it is possible to carry division of labour further than in small plants. Each person can be restricted to a single task, which can be rapidly learned and efficiently performed with a minimum amount of time-wasting movement which inevitably occurs when one person performs several different jobs. With specialised division of labour, then, production costs can be reduced. Large scale production, with specialised division of labour, often makes it possible to split operations into small units, each one of which can be taken over by a machine specially designed for the purpose. In a small factory such a process would not be profitable. It should be noted, though, that there are limits to the extent to which division of labour can be carried, even in the largest undertaking.

(d) **Economies of linked processes:** in a large undertaking it is often possible to link several consecutive processes together under one roof, thus resulting in the following economies being achieved:

(i) a saving in time and in transport costs;

(ii) a saving in fuel and power whenever the physical conjunction of two processes avoids the necessity for re-heating; and

(iii) there is the possibility of turning waste materials into by-products.

The second economy of scale deals with **managerial** factors and has two aspects. In the first instance, a large undertaking can buy in the open market the most able managerial skill available. Although it may be expensice, first rate managerial ability is always an advantage to a firm, especially when the cost of this ability can be spread over a large output. In the second instance, the power of a large firm resides in its ability to divide management into a number of specialised sections, each under the care of an executive who is a specialist in his particular field. The manager in a small undertaking, on the other hand, will often be responsible for the detailed planning and supervision of, say, buying, sales promotion, design of the product and technical supervision of production. It is, to say the least, doubtful if any one person can possess or acquire sufficient knowledge to manage all these fields effectively. In a small firm, however, there is insufficient work in each specialised field of canagement to make profitable to employ a specialist to head a specialised department. Furthermore, in a large undertaking, the senior executives can delegate routine wokr to subordinates, leaving the senior men free to plan, co-ordinate and control more effectively.

Economies of management, then, can only be achieved when production is on a large scale. **But**, and this is of the utmost importance, once an undertaking grows beyond a certain size the economies of management are replaced by diseconomies. This is because the larger the firm, the more difficult it is to control and the more complicated becomes the process of management, especially co-ordination, and the less flexible the undertaking becomes. It may also be difficult to find a chief executive who is capable of heading the management of a very large firm.

Thirdly, there are economies of scale due to **market** factors. These apply to the purchase of raw materials and the sale of the finished products. The importance of skilled buying of raw materials in efficient and economical production can hardly be over-emphasised. The large undertaking can afford to employ skilled buyers, who have an intimate technical knowledge of the raw materials used by the firm in question, and who are also familiar with all the sources of supply. These buyers are unlikely to be deceived in regard to the quality of the raw materials which are buying, nor are they likely to miss opportunities to obtain bargains. Being employed by large undertakings, they can purchase in large quantities with many economies resulting from this large-scale purchasing. Where conditions of manufacturing are fairly standardised, and the cost of raw materials is a considerable item in the cost of the finished product, it is not uncommon to find that the profitability of an undertaking depends more on skill in buying than on a high degree of efficiency in the factory.

On the selling side also considerable economies of scale are possible. An efficient selling organisation may be expensive, but when related to a large turnover it may be operating most economically. Travellers and agents, too, can take large orders as conveniently as small orders, and a large number of orders can be handled with little more expense than a small number.

In regard, fourthly to **financial** factors, the balance lies heavily with the large undertaking. In raising long-term capital, a large public issue of securities is relatively cheaper to make than a small issue. In fact, the cost of inviting the public to subscribe for securities, and the making of the issue, is often prohibitive to the small undertaking and so it must obtain its capital from other sources. It may also be easier for the large firm to raise temporary financial assistance than the small firm, and it is generally the case that a large firm inspires confidence in the mind of the public just because it is large, even though other small firms may be equally stable.

Finally, a large firm will find that its output is sufficiently large to enable it to spread its **risks** by —

(a) diversification of output;

(b) diversification of markets;

(c) diversification of sources of materials; and

(d) diversification of methods of manufacturing.

The economies, leading to a reduction of risk, are available only to a large firm, but the extent to which they can be carried depends upon the extent to which the diversification complicates management, and hinders the attainment of the technical economies of scale.

SECTION III: THE FINANCING OF ELECTRICITY GENERATING AND DISTRIBUTING UNDERTAKINGS

The electricity generating and distributing industry in Southern Africa is peculiar in the sense that, if we exclude the Electricity Supply Commission, only a very small part of it is in the hands of private ownership, **i.e.,** owned either by individuals or by companies. This being the case then, the greater part of the industry is financed from sources, and by methods, other than those found in manufacturing or commercial undertakings will be financed by the owner or owners investing in it their personal savings, probably augmented by such funds as they can borrow from such sources as commercial banks, other financial institutions and investors who prefer to lend money to business undertakings rather than to invest it in their own undertakings.

The Electricity Supply Commission is a public utility undertaking which has no shareholders or owners in the sense that a company has and its capital is obtained principally from the sale of stock by which money is borrowed from investors. The capital structure of the Commission as 31st December, 1961, was as follows:

Locally Registered Stock	R446,027,428
Loan from the International Bank for Reconstruction and Development	R22,891,072
Loan from Export-Import Bank of Washington	R10,233,666
Loan from the Commonwealth Development Finance Co. Ltd.	R2,180,000
Swiss Loan	R8,274,720
TOTAL	R489,606,886

The capital expenditure of the municipally-owned undertakings is also largely financed by borrowing, since again there are no owners whose savings can be invested in the undertaking. In virtually all cases of borrowing, the loans are repayable after a stated period of time, or on a specified date, with interest at a specified rate being payable in the interval. The rate of interest which will have to be paid varies from time to time, and depends upon such factors as:—

(a) the state of the capital and the money market — e.g. is it easy or difficult to borrow money;

(b) the competition for the available funds in the capital and the money markets;

(c) the borrower's estimate of the assessment by the investor of the risk involved, it being axiomatic that the greater the investor's assessment of the risk involved the higher the rate of interest which will be necessary to induce him to lend his money; and

(d) the security which can be offered by the borrower.

The loan may be repaid by setting aside out of revenue an annual sum so that over the tenure of the loan these sums together with interest if they are invested outside the undertaking, will provide a sufficient sum to repay the loan. This

method is commonly called the creation of a sinking fund. On the other hand, a loan may be repaid on due date by the flotation of another loan, the proceeds of which are used to pay back the loan which has matured.

Another source of funds for capital expenditure is what in a public utility undertaking could be called a surplus of revenue over expenditure. Now, in the normal course of events public utility undertakings are not expected, taken on the average, to make a profit in the sense that a privately owned undertaking expects to make a profit each year. Ideally, a public utility undertaking, after meeting its current operating costs, and providing for depreciation, the creation of reserve funds and the servicing of loans and sinking funds, should have no surplus remaining. In practice, however, it may be difficult to achieve such a fine balance and surplusses may arise in some years and these can be used to finance capital expenditure. This self-financing is a fairly complex procedure, and mention of certain aspects of it has already been made by the President in his Presidential Address. It should be noted, too, that in a municipally-owned undertaking any surplusses which arise in a year are usually taken for the relief of rates.

A question which now arises is the extent to which it is desirable and possible to obtain funds for capital expenditure by a deliberate policy of planning for a surplus after the above mentioned anuual expenditure committments and provisions have been made. From an undertaking's point of view there are several advantages in self-financing, the chief advantage being that the undertaking is freed from the necessity of paying interest to the lenders at stipulated intervals. The possibility of self-financing, however, depends upon the ability of the undertaking to charge a tariff which is sufficiently high to cover the expenditure committments of the undertaking and still produce sufficient revenue to create a surplus each year. This means, inter alia, that the undertaking must have an accurate idea of its operating costs at various levels of activity, and also of the level of activity at which it is likely to operate, or else the anticipated surplus may not materialise.

It might be appropriate to note here that steps are being taken in the Cape Province to compel Municipalities to increase the charges they levy for their services in order that what is termed a **revolving fund** may be built up by each Municipality. The purpose, it seems, of this fund is to help finance the needs of the municipality's trading undertakings for short-term capital.

A further matter to which it is appropriate to draw attention here is the depreciation of fixed assets. It is a cardinal principle of sound financial management that a certain proportion of the book value of fixed assets must be written off against revenue in each year. While there are various methods of depreciating fixed assets, the principle remains the same. It is not, however, to this aspect of depreciation to which I wish to draw your attention, but to whether the anual provision for depreciation is adequate or not. The problem here arises because of the continued increase in the general level of prices, or, in other words, the general fall in the purchasing power of money. If an asset is depreciated by a fixed amount being written off its book value each year, and a sum equal to this amount invested outside the undertaking, there will at the end of the life of the asset be a sum available for its replacement. Now if prices have risen during the life of the asset, it may well be that the accumulated funds will be insufficient to finance the replacement of the asset.

It has been suggested, however, that this situation is alleviated to a certain extent by the following factors:—

(a) although the asset's book value is written down to zero, it generally has a scrap value which, if realised, will augment the sum available for its replacement; and

(b) an asset is often given a shorter life for depreciation purposes that it has in fact in reality, so that the accumulated sum can earn interest for a number of years before the asset has to be replaced.

On the other hand, it should be noted that a situation can arise in which an asset, because of technological progress, ceases to serve any useful purpose long before its useful life has expired. This, however, is more likely to affect adversely a commercial or industrial undertaking faced by competitors, than an electricity generating or distributing undertaking.

It seems, Gentlemen, that this is a fitting point at which to terminate these thoughts on certain aspects of electricity supply economics and I trust that which has been said has been of interest, and perhaps of some value, to you.

The Effect of Standardisation on the Economy of Electricity Supply

By A. A. MIDDLECOTE
B.Sc.(Eng.), M.(S.A.)I.E.E.

Electricity Supply has been clearly shown to be one of the most important single contributions to the well being of any country. Examination has indicated that the varying stages of development reached by different countries and the inequalities in the standard of living of their people correspond fairly closely with the consumption of electrical energy per head of population. Thus we observe that highly developed countries such as the United States of America and Britain have consumptions per head of 4 Mwh and 2 Mwh respectively while a developing country like India has a consumption of 1/40 Mwh. On the other hand the rate of increase of the national supply of electricity in highly developed countries is usually 8 per cent. per annum which means that the electricity supply is doubled every ten years, whereas in developing countries such as India and China the rates of increase vary between 16 per cent. and 20 per cent.

Here in South Africa if we consider the white population alone the consumption per head is of the order of 2 Mwh but if the total population is considered the value is about 0.5 Mwh. The recent rate of increase has been about 8 per cent. This would indicate that South Africa, while to a degree highly developed, is still a developing country particularly when one considers the current programme for development of Bantu Areas. In fact one is often tempted to consider the Republic as having developing areas within a highly developed country. With this in view it is highly probable that the rate of increase of electricity supply in the Republic may well exceeed 8 per cent. per annum in the future.

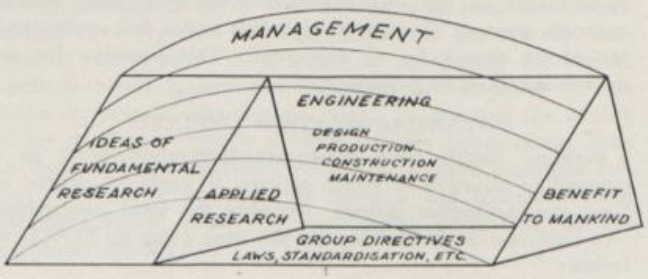
Since, generally speaking, the electrical equipment used in supply undertakings has a service life of 20 years or more, this means that the volume of work for the industries manufacturing such equipment as transformers, switchgear, insulators and cables depends to a large extent on this annual increase of electricity consumption. With the natural tendency for much of this equipment to be manufactured locally it is in the supply industries interest to ensure that such manufactures are of the requisite quality and reasonably priced. After all, the whole success of electricity as an energy supply to the community has been based upon its ease of transmission and conversion, its reliability and low cost. Encouragement of standardization in the manufacturing industries as well as the supply industries themselves can contribute much towards maintaining this.

STANDARDIZATION AND ITS RELATION TO GROUP ACTIVITY

Production of Electricity itself is a group activity in which all the members concerned are responsible for its success. As is the case with all engineering and industrial activity it is concerned primarily with developing the ideas of fundamental research for the benefit to mankind. To be successful, this development must be done in as short a time as possible and must result in a reliable economic benefit. To best sum up the main factors involved in this accomplishment I should like to summarize the field of group industrial activity in a simple diagram to make this point clear.

In this diagram the direct progress from fundamental research is shown as via applied research or development, and engineering (design, maintenance, construction, production, etc.). This progress is monitored throughout by certain accepted directives, the most important of which is standardization. Over all these, like a third dimension comes Management with its vision and co-ordinating functions. These separate sections must work together to ensure achievement in the fields of speed and economy. Speed or time of development has become of the utmost importance these days. One-hundred-and-fifty years elapsed from Copernicus' discovery of the laws of the pendulum till Galileo made the first pendulum clock. Only 19 years elapsed from the time even Rutherford considered there was no practical future for fission until Calderhall went on the bars. Such is the importance of the time factor these days. At the same time cost must not be forgotten. Much has been said about the part scientific management, applied research and general engineering plays in this activity, but the less obvious, nevertheless important contribution of standardization is frequently forgotten. Possibly this is because it is a factor rarely written directly into the normal scientific formulae upon which engineering design is based. It exists as a guide to prevent a design from becoming economically unsound in practice. As such it must be borne in mind throughout the applied research, development and production stages of a project and since it must never delay the progress of such a project it must in itself be dynamic and keep pace with the rapid technological changes taking place today. Always it must be such as to ensure that the ultimate project will be in the best economic interests of the community.

To illustrate its mechanism one might consider the most common electrical engineering design activity—that of design voltage. The best voltage for a given system or apparatus is the most economic one and there are numerous factors which decide this. When one has inserted these factors in a formula and differentiated this, one can arrive at the most economical voltage. But there is a relevant fact that such a formula cannot include, it is that machinery and apparatus becomes more expensive with every increase in the number



of different voltages for which designs are provided. The curve that relates voltage to cost is very flat in the region of its minimum and the effect on the manufacturing cost of an unnecessarily large number of different system voltages is to raise the whole curve. This effect on cost may be greater than that of choosing the nearest standard voltage to that which occurs at the minimum of the cost curve.

Leaving our field of electrical engineering, perhaps a better illustration is given in the following extract from an article in the New York World Telegram.

STANDARDIZATION NEEDS FOR SPACE PROJECTS

Several things have come to light that explain why the United States is lagging in space despite superior overall U.S. science and technology.

These United States mistakes and omissions explain why a Russian will probably get to the moon first, even though the $2 billion the United States has spent on space is considerably more than the Russians have poured in. The $20 to $40 billion U.S. moon programme is considerably more ambitious than the Soviet plan.

First—There are strong indications the Russians are ahead on key basic instrumentation. There is reason to believe the Reds can measure high temperatures more accurately. They can measure great thrusts more precisely. They can measure extremely heavy weight more closely. They can measure some electromagnetic waves more finely.

Second—The Russians have shown a greater willingness to *standardize* in all aspects of their space work.

This standardization results in more reliability and less cost. It means that any particular space project can be accomplished more quickly.

The United States has more or less tailor-made every job. The U.S. tends to build a separate vehicle for almost every space pay-load. We thus have too many varieties of stabilization systems for satellites, too many different types of power supplies for our satellites and space vehicles. We have too many different varieties of telemetering systems.

Tailor-making complicated electronic space gadgetry means creating new variations, each with a series of bugs that must be ironed out before the project can go ahead. The cut in realiability as a result of this variety is tremendous.

The successful application of standardization in the U.S.S.R. is no doubt to a large degree due to the ideology of the country. In a totalitarian atmosphere, when dealing with a group activity, incentives can be fed where incentives are considered necessary, directives can be dictated. In a free community such as our own standardization in a group activity can only succeed through co-operation and a full understanding of its objects by all concerned. This necessity for co-operation cannot be overstressed.

STANDARDIZATION DEFINED

Perhaps, having seen where standardization exists as a controlling directive in group activity, it might be desired to have standardization defined. Possibly the most comprehensive definition of standardization has been given by STACO as follows:

"Standardization is the process of formulating and applying rules for an orderly approach to a specific activity for the benefit and with the co-operation of all concerned, and in particular for the promotion of optimum over-all economy taking due account of functional conditions and safety requirements.

It is based on the consolidated results of science, technique, and experience. It determines not only the basis for the present but also for future development, and it should keep pace with advances.

Some particular applications are:

(1) Units of measurement

(2) Terminology and symbolic representation

(3) Products and processes (definition and selection of characteristics of products, testing and measuring methods, specification of characteristics of products for defining their quality, regulation of variety, interchangeability, etc.)

(4) Safety of persons and goods."

This standardization has to function in the industrial and engineering world where there are three main factors, the producers, the distributors and the consumers. It is common knowledge that competition often drives the older manufacturers to give up all idea of economic production and to make not only their own particular design of commodity but also those of their competitors. As to the distributor, his problem is possibly even more complicated. He has to carry an enormous variety of patterns or sizes of each commodity. Then there is the consumer, who wants something efficient yet easily replaceable and at the same time economic, but who may be confused or coaxed into bad buying habits by having too wide a choice.

Rationalization of such a situation is difficult because the manufacturers cannot easily approach the distributors and certainly not the customers. The distributor cannot easily approach the manufacturers or the consumers and yet these three sections have in reality a community of interest and their well being is interdependent. Standardization seeks a solution to this problem by functioning in four distinct phases —simplification; standards of quality and performance; testing and quality control and finally monitoring of standards. These phases are perhaps best understood when considered separately.

SIMPLIFICATION

The first phase of standardization is concerned with simplification whereby the interests of all concerned are brought together with a view to reducing unnecessary variety of articles or commodities for one and the same purpose. Clearly, standards activities which lead to simplification—that is fewer models, easier assembly, greater production—contribute greatly to our ability to take advantage of the unit cost—volume relationships. Standardizing on dimensions, on tolerances and on the characteristics of purchased materials is one familiar contribution. So is the work which reduces the variation between component parts and sub-assemblies and permits of flexible interchange. Simplification is a basic responsibility of the individual enterprise despite the work done by the standards organization on the national or international level. In the case of electricity undertakings for example, the

benefits of actively supporting efforts to simplify insulators even to the extent of dimentional standardization must result in simplicity of design, ease of maintenance, reduced stocks of spares and ease of tender adjudication—all of which paradoxically add up to a reduction in costs.

STANDARDS OF PERFORMANCE

The second phase of standardization is directed towards the co-ordination of the requirements of producers and consumers through the setting up of standards of quality, and performance so simplifying production and distribution and thus bringing about more equity in the purchase and sale of industrial materials and apparatus. For electrical equipment, quality is a vital ingredient second only to safety and any lowering of the standards would necessarily result in a sacrifice of efficiency and a shortening of the life of the equipment, apart from endangering the lives of consumers of electricity. To ensure that standards are dynamic and able to keep pace with rapid technological changes the accent in present day standardization work is on the performance requirements of specifications.

It is, however, in regard to this phase of standardization that most difficulty is encountered. In this connection I would refer to the practice of certain electricity supply undertakings, not only in this country, of framing their own distinctive specifications, obviously to meet their own special requirements. These special requirements may be based on time-honoured practice within the undertaking rather than on real technical or economic justification. However reasonable this may seem to be from the undertakings own point of view, their specifications may not conform in many respects to the national standard. This approach which is entirely against the philosophy of standardization and all that it stands for is one which I hope will soon vanish. Authorities sometimes use the national specification for a commodity, but add to the specification requirements of their own. This is equally contrary to the spirit of standardization since if a requirement is necessary it should be included in the national specification. Such difficulties have been encountered in South Africa particularly with products such as miniature circuit breakers. It must be accepted however that established custom frequently proves a stumbling block to the amount of standardization which can be achieved. In a free economy this problem can only be solved by co-operation.

TESTING AND QUALITY CONTROL

The third phase is that of testing, the establishment of standard methods of test and encouragement of quality control. Apart from the need for standard test methods as the only true means of comparing the performance of commodities this phase also includes that of continued testing of commodities manufactured to a specification to ensure that these do in fact comply. This may be achieved by consignment acceptance testing or in some cases more economically by the support of a standardization mark scheme. This phase is probably of more apparent advantage to smaller electricity undertakings which cannot afford to maintain test laboratories or the necessary technical experts.

MONITORING OF STANDARDS

The fourth phase concerns the monitoring of standards to ensure that they are in fact succeeding in the object for which they were created and also to ensure that the standards are dynamic. Any industrial enterprise would be in danger if it failed to recognise that its healthy existance in a highly competitive world depended on continued and careful consideration of new designs available in the light of rapidly changing technology.

Such technology can overthrow tradition, change the customers' requirements, and abruptly realign the relative importance of resources available, e.g. nuclear fuel. Such dynamic technology therefore demands dynamic standards. To obtain truly dynamic standards two things are necessary. Firstly at all levels of standardization we must learn to regard every standard we adopt, not as a law of the Medes and Persians, but rather as a record of the currently optimum method. We must expect standards to change and have a mechanism to revise them promptly in order to record a newer and better method. In the second place we must standardize for the future as well as the present.

While this monitoring can to a degree be achieved by constant liaison between the standards body, manufacturers and consumers, a much more efficient and economic system exists in a standardization mark scheme. Apart from the value of such a scheme in a market in which the main final customer is more or less a layman in any case with little knowledge of the essential requirements of the commodity concerned, a standardization mark scheme can ensure the dynamics of the standard concerned. When a standardization mark appears on a commodity, and that commodity fails to give satisfaction, complaints will be raised with the standards body responsible as opposed to the resignation that one has made a "bad buy" when failures occur on a commodity without the mark. Such complaints if rationally analysed will lead to the necessary "dynamic" revisions. In fact the whole world of manufacturers and consumers becomes the specification committee. Monitoring of standards also educates the consumer. Thus analysis of complaints levelled against a standard product often reveals a misuse of the product by the consumer. For example complaints regarding cables might indicate poor cable jointing or termination technique; complaints regarding electric storage water heaters might reveal poor plumbing practice.

In many cases it is best to deal with such situations by drawing up a Code of Practice for the use of the product concerned.

STANDARDIZATION MARK

At this stage it might be in order to say a little more about the standardization mark scheme being undertaken by more standards bodies every year. This is not a particular phase of standardization but a tool of standardization with which certain of the phases are dealt with. As has already been pointed out it exists as a means of monitoring the correct application and dynamics of the standards themselves. It also helps the layman who has no means of assessing the quality of his purchases. Finally it offers to large undertakings, even to those with the necessary know-how a more economic system of checking purchases of material and equipment than the consignment inspection and testing undertaken by the purchaser himself.

Perhaps the last point could be made clearer by a simple example. To examine a consignment of a given commodity correctly in order to ensure reasonable compliance with specifications, it is usual to test samples drawn from the consignment. The size of a sample is determined statistically in accordance with reasonable consumers risk (i.e. the risk that a faulty consignment may be accepted) and producers risk (i.e. the risk that a satisfactory consignment may be rejected), and varies with the size of the consignment.

A typical sampling in a specification for miniature circuit breakers might be:

No. of breakers in Consignment	Number to be Tested
100	5
101—500	10
501—5000	15

In such a case if the consumer were to test the consignment himself and such a consignment were 100 units and the cost of each test RX then the increase in cost of a unit would be R 5X or R0.05X per unit.

100

If a standardization mark scheme were resorted to the authority responsible would, in the simplest form of such a scheme, test larger consignments. Taking 2000 as a typical value the increase in cost of a unit would be R 15X or

2000

R0.0075X per unit. This represents a considerable saving.

In practice a properly controlled standardization scheme would be a combination of quality control of the production line and modified sample testing which gives an even lower cost per unit than this as well as greater assurance of conformity. It also encourages the application of quality control in industry.

It is difficult to give exact figures but it has been calculated that the cost of consignment inspection will vary from 1 per cent. to 7 per cent. according to the size of consignment whereas the cost of a standardization mark scheme is between ¼ and 1 per cent. A further rationalisation which accompanies the acceptance of a standardization mark scheme concerns the difficulty of dealing with the costly so-called "type tests". In specifications it may be most desirable to verify certain performance data but at the same time very costly to do so. Examples are the ability of large transformers to withstand the mechanical forces imposed by short circuits, the capacity of components of a power system to withstand surge voltages such as those generated by a surge generator and the rupturing capacity of circuit breakers. If scientific considerations alone had to be met, there would be no doubt concerning the desirability of standards for all such performance data together with standards for the means of verifying them.

But there is often a wide gap between what is scientifically ideal and what is economically wise. This has usually been overcome in the past by accepting such tests as type tests which once having been carried out on a sample submitted by the manufacturer are accepted for all time. This is not always reliable. Here one might quote the type tests on ceramic insulators. Although these do rely to a large degree on the inherent design of the insulator they do also depend on the characterists of the "body" or actual ceramic used and this can vary with the source of supply of the raw materials and the quality control in the factory.

In such cases the standardization mark scheme permits of such type tests to be done at regular intervals without adding considerably to the cost of the tests for the individual consumer.

When all these phases and tools of standardization are made the responsibility of a single standardization authority such as the South African Bureau of Standards in South Africa it is quite obvious that large laboratories, testing facilities and the necessary expert laboratory staff are essential requirements of such an organization. In South Africa the extensive S.A.B.S. laboratories at Pretoria have done much to promote standardization in South Africa.

VOLTAGE STANDARDIZATION

The most fundamental aspect of standardization in the electricity supply industry is that of standardization of power supplies. A most important characteristic is that of frequency. It is unfortunate that from the international point of view Europe chose 50 hertz and North America 60 hertz. At least here in South Africa we have managed to standardize on 50 hertz.

Such is, however, not the case when system voltages are considered, particularly those below 1000 volts. The International Electrotechnical Commission when faced with the large amount of different voltages used throughout the world has, as a compromise, recommended two series of voltages as follows

127—220—380—500 and
120—208—240—277—415—480—600

and stated that only one of the series should be used in a country and that, for the second series a choice should be made between 240—415 on the one hand and 277—480 on the other.

In South Africa the situation is disappointing, for despite the declaration of 220—380 as the standard system voltage in the Electricity Act the variation in system voltages in the country not only includes voltages from both of the international series but additional voltages such as 200, 230 and 250 which appear in neither series.

It is, however, significant that approximately 145 out of 176 undertakings in Southern Africa have standardized at 380/220 volts and therefore obvious that the standard voltage for this country should remain at this. One is fully aware of the difficulties involved in making this change for some undertakings. At the same time one must be convinced that no sacrifice is too great to achieve this end and the sooner it is done the better, not only for the power supply undertakings but even more so for the consumers and manufacturers. The direct cost to an undertaking and its consumers for going through

a voltage rationalization scheme today would be a small fraction of the gains which consumers of the future would get, not to speak of the far reaching advantages to the electrical manufacturing industry and its development of both the supply industry and electrical manufacturing industries of countries which are developing as fast as the Republic. Simplification particularly in the motor, transformer and lamp industry depends on this.

The same situation, though to a lesser degree, exists for voltages in excess of 1000 volts and a programme of rationalization here to the series 3.3—6.6—11—22—33—66—88—132—275—380 kV would undoubtedly be to the economic advantage of the country.

TRANSFORMER STANDARDIZATION

Perhaps one of the most interesting fields in which standardization has benefits to offer is, that of that maid of all work on distribution systems, the distribution transformer. There are at present over 12,000 of these in the Republic and since at least 13 firms have started manufacturing them locally it is felt that everything should be done to promote their standardization.

In the first instance, the benefit of system voltage standardization when rationally applied to the winding connections, voltage tappings and voltages can result in simplification. It is possible, however, that confusion regarding the difference between the declared voltage of a distribution system and the rated secondary voltage of a transformer has added to the difficulties which already exist because of variations in system voltages. Thus some authorities having a system voltage of 220/380 might order transformers having a rated secondary voltage of 220/380. Others might order 230/400 rated secondaries to cater for average regulation. It should be decided once and for all what the relationship between system voltage and rated transformer voltage should be. Probably the relation of 220 to 230 is legitimate.

This agreement is also necessary before any attempt can be made to standardize on voltage tappings and doubtless such standardization would be beneficial.

Standardization of accessories could go far towards the prevention of unnecessary ordering by those who believe "the more gadgets the better." This refers particularly to the fitting of unnecessary dial thermometers, bucholz relays, etc. on small transformers. For example if a national directive could be given as to when a conservator tank should be fitted it would do much to help the purchaser who cannot quite make up his mind and specifies one just in case. The consensus of opinion appears to be that conservators are not necessary on transformers smaller than 200kV.

Other contentions points centre round such questions as whether desiccators should be fitted to free breathing pole mounted transformers and whether the additional cost of fitting explosion vents is justified in view of the doubts as to their useful function.

Standardization of features such as rollers, skids, mounting devices in the case of pole mounted transformers and critical overall dimensions could be of immense help to the consumer by ensuring interchangeability of units purchased on an open competitive market.

Insulator bushings are not usually manufactured by transformer manufacturers themselves. With standardization of these the insulator manufacturer could reduce costs since a wide variety of bushing for different transformer manufacturers would no longer be necessary and the small multifarious demands of individual transformer manufacturers would become large simplified demands from the industry as a whole. The electricity supply undertakings themselves would also have a direct saving by carrying smaller stocks of spare bushings for maintenance and repair purposes—in fact they could in many cases carry no stocks at all as the standardized bushings would be readily available.

Standardization of the ratings of these transformers would help to take advantage of the unit cost—volume relation. There is often false economy in the belief that transformers cost RX per kVA—which assumption often results in an odd rating as being the most economic proposition. In practice an 87.5 kVA transformer costs little if anything less than a 100 kVA transformer and is in fact a source of unnecessary annoyance to the production line manufacturer.

STANDARDIZATION OF LOSSES

Transformer losses possibly provide the greatest single cause for the large variety of transformers manufactured in South Africa.

This is due to the fact that the purchase price of transformers is generally based on some sort of capitalization formula whereby the annual costs of supplying the losses of a transformer are capitalized over its life. This sum is added to the primary cost of the transformer forming a capitalized cost which is used ultimately for tender adjudication purposes. These formulae vary considerably between different purchasers, the result being that the transformer designer has to design transformers against each capitalization formula. A tpyical argument is as follows:—

"For the transformer under consideration let:

Wf be the iron loss in kilowatts

Wc be the copper loss in kilowatts

f be the load-factor of the transformer

d is the cost of a unit of electricity in pence per k.w.H.

a be the annuity factor corresponding to the assumed useful life and the rate of interest

The annual cost of supplying the losses $=R72.4\ (Wf+fWc)$

The equivalent capital cost of losses $=R72.4\ a\ (Wf+fWc)$

This must be added to the price of the transformer to get the total equivalent capital cost."

While this argument is all very well when applied to large, expensive transformers it is felt that attention must be directed to the following dubious factors in the capitalization equation, which can be misleading when applied to small distribution transformers.

In the first case the purchaser has to assume a value of the load factor. It is doubtful whether many engineers can give an accurate value for the load factor of the average distribution transformer save that it is probably between 0.2 and 0.35. The effect of this uncertainty on the legitimacy of the capitalization formula can possibly be demonstrated by the following example.

A transformer A costs R1,200 having a copper loss of 4,000 W and an iron loss of 900 W. A transformer B costs R1,240 having a copper loss of 3,250 W and an iron loss of 1,000W.

With an energy cost of ¼d. per unit it will be seen that transformer A will be the more economic proposition by capitalization clause if the load factor is 0.2, but transformer B will be the more economic if the load factor is 0.35.

In the second case the life of the transformer is assumed. This presumes that all transformers have the same life. Finally the cost of electricity and interest rate are taken as constant over the life of the transformer.

The simplest alternative to this approach—and one which will reduce variety of units—is the acceptance of standardized losses on distribution transformers. This has, in fact, been done by the Central Electricity Authority in the United Kingdom and has been favourably accepted by the majority of manufacturers. This approach would also considerably simplify tendering procedure both from the manufacturer's and consumers' point of view.

The main argument against such acceptance is that this would not take into account the large variation in energy costs in South Africa—a problem not encountered in the United Kingdom. While this claim is legitimate in theory, in practice over 75 per cent. of the units sold in South Africa are sold at a unit cost variation not much different to that in the United Kingdom. Should not therefore the advantages of standardized losses be made available to the majority, leaving the minority to resort to the capitalization formula?

This very contentious question should be tackled as soon as possible in the best interests of the country. If standardized losses are found to be unacceptable, at least the variety of types of capitalization formulae should be reduced by accepting one as a standard.

CABLES

A fruitful field for standardization exists in the cable industry. Indeed it could probably be stated without fear of contradiction that it is an industry in which co-operative standardization has played an important part for many years. A very good example of the value of standardization in this field occurred recently when excessive trouble was experienced with 11 kV cables. During the investigatory period the cable industry had to face up to a large variety of different standards being set by different consumers to deal with the situation. This had anything but a beneficial effect on the manufacturing costs of the cables. Co-operative standardization resulted eventually in a standard being established which it is hoped will be supported with resultant beneficial economic effects. In addition the process of standardization indicated a misuse of cables by many consumers but it is hoped that education in this regard—as pointed out one of the phases of standardization—must eventually also have a beneficial economic effect.

Standardization can continue to be of benefit in this field particularly with the rapid development of the newer types of plastic cables. Their extended use in the supplies in native townships is alone a fruitful field. Standards of quality and performance to cover exposure to the severe climatic conditions in the Republic should be determined nationally by co-operation of all concerned and the maximum benefits of simplification of types and sizes achieved. We have here many factors which force us to depart from certain international recommendations which it is normally advantageous to accept. These factors are high temperature, high humidity, sunlight, rodents and termites to mention some. However, these should be considered in a national specification and not in individual specifications.

It is quite interesting to note that when considering developments in such new fields one of the fundamentals that we come across in evolving electric standards is the much discussed question whether standards for a particular product should come first or whether the setting up of that industry or the start of production of a new product should take precedence. One cannot afford to be dogmatic on this point but it would seem that for a developing country with targets set for rapid progress it would be more advantageous by and large to evolve standards even in advance of the product. This would be of help to entrepreneurs to set about establishing the industry on the right lines. It could also prevent a situation arising where two or even three factories manufacturing the same product are tied to two different overseas standards. These standards might be widely different and make it impossible for a single national standard to be set wthout adversely affecting one or both manufacturers. Situations such as this create many tender adjudication difficulties. In fact market chaos can result.

CONCLUSION

The exact products used by the electricity supply industry where standardization can lead to economic benefit are unlimited. The major category naturally covers those which are mass produced and comprises electrical accessories, wires and cables for use in domestic and similar installations, fuse gear, miniature circuit breakers and appliances, tools and other apparatus for domestic and similar general use. Apart from essentially electrical commodities items such as paints, poles, lubricants and oils, solder and protective clothing are concerned—particularly so since even the best electrical engineer has no expert knowledge of these. But, it must be repeated that without the co-operation of all concerned, standardization cannot succeed. With this necessary support electricity supply undertakings can be assured of many economic benefits. The task for standardization is a compelling one. It is hoped that this paper has indicated the many challenges involved which demand that co-operative effort for standardization must rise above simple compromise of separate interests.

It must seek instead to melt those interests into new common denominators which all parties concerned can share enthusiastically. These are obligations which have to be undertaken for the economic welfare of all mankind.

With this in mind I should like to end by quoting from the Third Le Maistre Memorial Lecture delivered by Prof. R. D. Kapp.

"A standard specification could be perfectly logical, comprehensive, clear, attractively worded, constructed in the most methodical manner; it would still be useless if it had not been prepared with a due sense of what is relevant to the situation. If engineers did not take the whole world of reality into consideration, with all its faults and blemishes, if they did not hospitably welcome to their debates all relevant facts, including the troublesome ones, the regrettable ones, the ones that contradict their most cherished convictions, they would be as far from reaching agreement among themselves as are the philosophers."

Electricity Costs and Tariffs

by JOHN H. WEST, M.B.E., B.A. (Com.), M.Econ., F.I.S.,

Under Secretary, Ministry of Finance, Federation of Rhodesia and Nyasaland.

In the last financial year the revenues of all public undertakings in the Federation amount to £11,704,000, which was only £44,000 more than their combined expenditures. One undertaking, namely the Southern Rhodesia Electricity Supply Commission, made a substantial loss, and one undertaking, namely the Federal Power Board, made a substantial profit. Government-owned undertakings as a whole made a loss of £82,000, whereas Municipally-owned undertakings made a profit of £126,000. The Federal Power Board is obliged to make sufficient profit to pay for half the cost of constructing Kariba Stage II. The Federal Government's two Supply Commissions are required to ensure that revenues cover costs taking one year with another, costs being defined to include increases in the cost of replacing assets. Municipalities generally sell at prices which permit a contribution to the general rates fund, though some municipal undertakings in Northern Rhodesia are subsidised by the Government. Nevertheless the losses and subsidies are intended to be temporary and on balance it can be said that electricity prices are largely governed by the cost of production.

Thus the Federation does not in principle subscribe to the theories of people such as Gunnar Myrdal,(1) who believes that national planning cannot rationally be made in terms of costs and profits of individual enterprises. It may well be true as he says that "every new investment and enterprise has another and additional sort of yield besides the expected money return and that . . . . . investment in power can very well provide that decisive stimulus which will permit a country to begin what has been called the take-off into sustained growth, enabling it to lift itself by its shoe strings.(2)

This is a philosophy which has a strong appeal to the Government of an under-developed territory relying to a large extent on loans from affluent countries and financial institutions overseas. Despite the attractiveness of this philosophy it has not been adopted by the Federation, which broadly speaking has accepted the principle that each electricity undertaking should pay its own way. In a sparsely populated country not yet covered by a comprehensive transmission system and with distribution largely in municipal hands, it would be difficult to follow any other policy. It must be admitted, however, that the existence of 26 public undertakings in the Federation, each operating as an individual identity, produces some arbitrary effects. A large undertaking usually has lower costs than a small one, and a hydro installation usually has lower costs than a steam plant. Thus the price paid by a consumer depends on which undertaking serves him. Householders in small towns like Hartley and Marandellas who are supplied by the large Southern Rhodesia Electricity Supply Commission pay less than those in Ndola and Lusaka who are supplied by relatively small undertakings.

(1) Economic Theory and Under-developed Regions, London 1957, pages 86-97.

(2) The Problem of Energy in Undeveloped Countries, World Power Conference, Belgrade, 1957.

Consumers in high tariff areas naturally argue that all costs should be pooled so as to make possible a unified national tariff. This could be done either by nationalisation, or by subsidies to high cost producers financed from levies on low cost producers, or from general taxation. The political feeling for nationalisation is not strong however, and the majority of consumers — who are supplied by the big low-cost undertakings— would naturally resent being levied for the benefit of consumers in other areas. It also seems wrong in principle for part of the cost of electricity to be met from taxation, particularly since (without nationalisation) a unified tariff would involve subsidies to all undertakings except the one with the lowest costs. There is also the argument that to subsidise certain undertakings would remove one of the economic factors affecting the location of industry and population. This could react on the costs of electricity since the effect might be to transfer demand from the low cost areas to the high cost areas, thus increasing the national average cost and reducing the nation's real income.

Electrical engineers group costs into those which are fixed and those which are variable.(1) Sometimes the words "overhead" and "incremental" are used in place of "fixed" and "variable". Fixed costs are those which in the short run are independent of output and have to be borne whether an undertaking operates at its maximum level or at only a fraction of that level. They include interest, loan redemption, depreciation, and the wages of those personnel who must be employed if any output at all is to be produced. There is clearly room for differences of opinion as to the precise composition of fixed costs but the concept is generally accepted even if its interpretation is not always clear. Fixed costs can thus be regarded as constant in total in relation to a given installed capacity — whether of generators, transmission lines, distribution systems or staff — which in a well planned undertaking should be closely related to the peak load. Fixed costs are therefore a short term phenomenon since they change with any change in installed capacity.

Variable costs are those which vary with the size of output, e.g. coal, water, oil, ash disposal, etc. Here again there are differences of opinion as to what should be included under this head particularly when it comes to such items as the wages of meter readers, billing clerks and so on. Variable costs can be considered as constant per unit of output but fluctuating in total from hour to hour and from day to day in accordance with the quantity of electricity generated or distributed.

The concept of fixed and variable costs is not peculiar to the electricity supply industry. In some measure it applies to all industries but for several reasons it is of particular relevance in electricity supply. One is that both power stations and distributing undertakings normally produce a single homo-

(1) There is a third category, namely consumer costs, but to the extent that they are covered by connection fees and capital contributions, they do not affect the arguments in this paper.

geneous product, so that some other cost problems such as by-product costing or allocating costs over a range of products do not arise, and attention can be more concentrated on fixed and variable costs than is the case in most other industries. Another is that electricity supply is normally operated as a public monopoly and the absence of direct competition means that prices can be based more on costs than on other producers' prices. A third is that electricity supply requires a high capital expenditure per £ of sales (£11 of capital to every £ of sales in the Federation in 1959/60). This means that fixed costs, which are the ones that cause most difficulty, are a higher proportion of the total than in most industries.

Undertakings in the Federation do not publish figures showing costs split into fixed and variable, and the Ministry of Power's Annual Censuses are more concerned with the split between generation and distribution costs. It is usually agreed that imported power (when purchased at a flat rate per kWh) can be included under variable costs. So can fuel and water. Interest, depreciation and redemption are equally clearly fixed costs. The problem arises in allocating other generation and distribution costs and administration and general expenses. If we take roughly 60% as fixed and 40% as variable, then the results for all public undertakings in the Census Year 1959/60 are as follows:—

Overhead (or Fixed) Costs.	*£'000*
Generation	540
Distribution	561
Interest	2,331
Depreciation/Redemption	1,682
Administration and General	558
Total	5,672
Incremental (or Variable) Costs.	
Imported Power	100
Fuel	1,812
Water	166
Distribution	374
Generation	360
Administration and General	372
Total	3,184

Thus the fixed costs represent 64% of the total and variable costs 36%. This may not seem very precise but a lot of time can be spent on increasing precision without any commensurate return. This is so simply because costs are not constant. If fixed costs are scientifically ascertained to be 64% today, then tomorrow, with an increase in output they may be only 62%. The length of the period under consideration is also an important factor. If a power station has surplus capacity now, there may be economic advantages in obtaining new loads at prices which cover little more than incremental costs. It does not follow that such loads would necessarily be economic later, when the installed capacity has to be increased and the additional fixed costs have to be paid for by other consumers. In the long run all costs must be covered. Indeed in the long run all costs may be said to be variable.

In the short period fixed costs are closely related to the peak load. It is the demand for electricity at one particular hour during the year which determines the capacity which the undertaking should have available, and therefore in a sense the whole of the fixed costs are attributable to the peak whereas the variable costs are attributable to the whole output during the year.

This theory is so simple and attractive that its practical implications have interested economists and engineers since the early days of the supply industry. As long ago as 1892 Hopkinson argued that consumers should pay for electricity on a two-part tariff. The first part would be related to the fixed costs and would therefore be a function of the maximum demand. The other part would be related to the variable costs and would therefore be a function of the number of units consumed. There are, of course, some practical difficulties in devising such tariffs even if one starts from the assumption that all consumers should pay exactly the cost of supplying them. One is that maximum demand meters are expensive and can only be justified for relatively large loads. They would be quite inappropriate for domestic consumers and for most commercial and farming consumers for instance. Another is that the fixed costs are related to the annual peak load on the undertaking whereas the consumers' peak load often occurs at a different time. A rough allowance for this can be made by measuring the diversity factor of the group of consumers concerned but this is not always practicable and is usually costly. Moreover it does not avoid inequity as between individual consumers.

Hopkinson's two-part tariffs — despite the fact that they cannot be mathematically precise — have nevertheless become very popular and now number 35 out of the 185 public supply tariffs in the Federation. Of the remaining tariffs 113 are of the block type which involve high charges for an initial quota of consumption, normally with some relevance to the undertakings' fixed costs. The other 37 tariffs are either flat rates applicable to small consumers or special tariffs, e.g. off-peak.

Because of the inability of either two-part, block, or flat rate tariffs to reflect an exact allocation of costs, many economists have urged the adoption of time of day tariffs. The essence of such a tariff is that energy consumption during peak hours is charged at a much higher rate than energy consumed during non-peak hours. Some people regard time of day tariffs as merely the converse of off-peak tariffs, but this is not so. Off-peak tariffs are offered to a relatively small number of relatively large consumers whose load characteristics are such that with a little financial inducement they can shift their demand to off-peak times. Thus an off-peak tariff is merely one specialised scale out of many. The protagonists of time of day tariffs have in mind that practically all consumers will be on the same tariff with no distinction between domestic, commercial, mining, farming, industrial, etc. Only energy would be measured — not power — and at peak times the price would be something like seven times(1) the price at non-peak times. Each consumer would have two meters, the switching between them being controlled either by a clock or a ripple relay system.

(1) According to H. S. Houthakker, Electricity Tariffs in Theory and Practice, Economic Journal March 1961.

Time of day tariffs would no doubt reduce peak loads and improve load factors, thus reducing capital costs and maximising utilisation. They would probably result in a lower average cost per unit of electricity. But the fact that hardly a single undertaking in the world has adopted them suggests that they have more disadvantages than advantages.

One major drawback is that it is easy to talk about the peak but not so easy to define it. I.M.D. Little[1] who is one of the chief advocates of time of day tariffs admits that "only after the event can the entire marginal capacity cost be attributed to a single half-hour in the year or at least to a few half-hours." Obviously neither supply undertakings nor consumers would wait a year before deciding the price of electricity. Little continues, "the capacity costs must be allocated between the different hours according to the probability that each hour will be the peak hour for the system . . . . Only about 600 hours per annum have any chance of being the peak." According to his calculations the proper cost of electricity in England was 8.1d. per unit at the December peak hour ranging down to only 0.46d. on a summer evening. An immediate objection to time of day tariffs is therefore that if costs do vary in this way then a dual price system would be unlikely to match costs any better than a two-part or block tariff. Another is that to define the peak is a matter of opinion unless one means the single hour in the year when demand is greatest. This would obviously be inequitable as the effects would be quite arbitrary. Moreover all consumers would do their best to dodge the peak. But if one is considering a much broader peak then who is to say whether 600 hours in the year is a more appropriate period than say 400 hours?

In practice time of day tariffs would have to take some simplified form, e.g. a low rate throughout the year and a high rate from say 7 a.m. to 7 p.m., during the three winter months. This would involve expensive meters in every consumer's premises and of course by definition the revenue from non-peak use would be small. For this reason the Clow Committee, while appreciating the merits of peak period pricing, recommended merely a surcharge of 0.35d. per unit during the winter quarter and a reduction of 0.1d. in the remaining three quarters. This was actually tried in the United Kingdom but was abandoned after the first year because it was generally considered to be harsh and unfair and also because it apparently had no effect on the load at the critical peak hours. This of course was in the days when coal was rationed and consumers without coal had to use electric fires or freeze. A less obvious objection to peak load pricing is that it is not altogether fair to allocate the overhead costs strictly according to the peak load. If it were not for the fact that there were troughs as well as peaks — particularly seasonal troughs — it would not be possible to maintain the plant and have it all ready to meet the anticipated peak.

It would seem, therefore, that time of day tariffs are no more efficient than two-part tariffs as a method of allocating costs equitably to consumer groups.

Basically there are only two methods of allocating overhead costs in proportion to peak load, namely on maximum demand or on energy consumption during the peak period. But clearly there can be variations on these two themes and in 1945 the British Electrical and Allied Industries Research Association reported[1] on an analysis it had made of nine recognised methods:

(1) *Consumption* — Costs are allocated to each consumer in proportion to the energy consumed during the peak hour.

(2) *Peak Responsibility* — each category of consumer pays its share in proportion to its maximum demand during the undertakings' peak hours.

(3) *Maximum Demand* — each category pays according to its maximum demand whenever it occurs.

(4) *Punga* — a compromise based on an average of (2) and (3).

(5) *Lauriol* — based on the use of each set at each hour, in terms of energy.

(6) *Phantom Consumer* — based on allocating unused capacity in proportion to the excess of each consumer category's demand at the peak over its annual average demand.

(7) *Complete Peak* — a mixture of (5) and (6), but based on a longer peak extending over the whole portion of the load which on the peak day exceeds the average load for the year.

(8) *Greene's Method* — based on consumption and maximum demand regardless of diversity.

(9) *Potential Peak* — based on maximum demand and consumption during potential peaks, i.e. a long period excluding all troughs but including all minor peaks.

Taking typical categories of consumer the Research Association then worked out how the overhead costs would be allocated in accordance with each of the above methods. The extreme degree of variability is indicated in the following table, in which the percentage refers to the proportion of total overhead costs attributed to the consumer category and the figure in brackets refers to the methods listed above:

ALLOCATION OF OVERHEAD COSTS

Category of Consumer	*Lowest Proportion*	*Highest Proportion*
Lighting	9% (2)	30% (9)
Heating	11% (1)	45% (2)
Industrial	20% (3)	33% (2)
Off-Peak	Nil (2) and (9)	27% (1)
100% L.F. Load	9% (4)	27% (1)

Each method can be justified on theoretical grounds and each has its supporters. Number (3), the maximum demand method, originally suggested by Hopkinson, is the one which has become most popular, though it can only be applied to consumers big enough to justify the installation of special meters. Method No. (2) is the one used by the Southern Rhodesia Electricity Supply Commission in principle, though

(1) The Price of Fuel. Clarendon Press, Oxford, 1953, Page 57.

(1) Technical Report. K.T. 109, London.

in the absence of special meters or ripple systems to record demand at the undertakings' peak hour, each consumer category's own peak is adjusted by a diversity factor.

Of course even if an undertaking can establish to its own satisfaction how the costs should be allocated to the consumer groups there still remain the practical difficulty of doing so in an acceptable way. Where special metering can be justified it is relatively easy to determine a charge per kW or KVA of maximum demand, applying appropriate factors where necessary to convert from annual to monthly billing. For small consumers — who constitute the majority — reliance has to be placed on block tariffs, the object being to design the blocks so that the average consumer pays an amount equal to the overhead cost of supply per consumer, and each category of consumer as a whole pays an amount equal to the total overhead costs for that category.

It may be concluded that any attempt to charge consumers precisely the cost of supplying them does not permit of an unequivocal solution.

But should this be the object? The usual argument is that to base prices on costs is the only way to avoid discrimination between consumer groups. Yet it has been demonstrated above that cost allocation is a matter of opinion and the various methods produce widely varying results. Moreover there are other principles which should influence the prices which consumers pay. They are:

(a) Value of Service;

(b) Ability to pay; and

(c) Stimulus to improved utilisation.

The first refers to the fact that a unit of electricity is worth a different amount for each of its uses. Consumers are ready to pay a high price for electricity used solely for lighting because there is no real substitute. It costs no more to supply a unit of electricity for lighting than for heating but suppliers would be foolish to charge the same price, as this would mean sacrificing revenue which could be used for development. A unit used for power purposes is also much more valuable to the consumer than one used for heating, but in both cases the cost of alternative forms of energy is a factor which should be taken into account in fixing the price.

The second principle, ability to pay, is called by the railways "charging what the traffic will bear." For some consumers the cost of electricity is a trivial part of total expenditure whereas for others it is a major cost. In economic terminology the elasticity of demand of the former group is low whereas for the latter it is high. Electricity prices should therefore reflect the different elasticities, being high where elasticity is low and low where it is high.

The third principle refers to the economic advantages of increasing total output and of improving load, power, and diversity factors. A large undertaking almost invariably has lower overall costs than a small one, and in present circumstances in the Federation it is vitally necessary to expand sales since every additional unit generated at Kariba costs practically nothing. In normal circumstances it is as important to improve load factors as to increase total output since this results in spreading the overhead costs over more units. In the Federation, however, there will be a considerable surplus of capacity for the next few years and it is difficult — in the national context — to see any immediate need for improvement of load, power, or diversity factors if this inhibits any expansion of total output.

This paper might be regarded as an argument against cost analysis and in favour of using less tangible principles of tariff formulation. The writer therefore wishes to make his position clear. He is strongly in favour of cost analysis and considers that much more should be done to establish the true cost of supplying various loads. In particular the incremental cost of supply should be calculated and no consumer under any circumstances should be charged a lower follow-on rate than this. The overhead costs of supplying different consumer groups should also be studied and more use should be made of sampling methods to determine their loads at peak periods. But having calculated costs on whichever method happens to be preferred (preferably on more than one), undertakings and regulating authorities should remember that the other three principles are also important, and due weight should be given to them in the formulation of tariffs.

Discrimination is thus not an evil but something to be recommended provided it does not go too far. In fact "discrimination is the secret of success."(1) It enables the supply industry to absorb some of the consumer's surplus which flows from the principle of marginal utility, and above all, it enables supply authorities to finance some of their development from funds contributed by the electricity consumer instead of from the nation's strictly limited loan funds.

---

(1) J. M. Clark. Studies in the Economics of Overhead Costs. University of Chicago. Press 1923.

The Development of a Power Station for an Isolated Community

by

Y. E. O. BARRATT,
Electrical Engineer, Queenstown

1.0. Queenstown celebrated its centenary in 1953 and by then had grown to a town with a total population of 26,788, of whom 9,017 were whites. It is situated in the heart of the Border, remote from comparable or larger towns, for East London lies about 138 miles by road to the south, Aliwal North 101 miles to the north, Cradock 89 miles to the west and Umtata 147 miles to the east.

1.1. The Municipal Electric Light Scheme was inaugurated on 9th November, 1912. The late Mr. W. Bellad-Ellis had consulted for the scheme and, eventually became the town's first Electrical Engineer. Incidentally, he was a Foundation Member of this organisation and, at the first Congress of the Association of Municipal Electrical Engineers, held in Johannesburg from 15th to 20th November, 1915, read a Paper entitled "Diesel Engines and Liquid Fuels."

2.0. The original capacity of the Power Station was 100 K.W. D.C. with diesel prime-movers. There was also a battery to take care of the light night loads. A further 50 K.W. D.C. diesel-set was installed in 1915. This 150 K.W. was able to supply the needs of the town through the first World War period and on till 1921, when two steam-driven reciprocating engine/alternator sets of 75 K.W. each were installed. The supply to part of the town was now changed over to alternating current.

2.1. Early in 1925 it had become apparent that further extensions to the power plant would be required to keep abreast the steadily increasing loads. It was ultimately decided to abandon diesels as prime-movers, to move the Power Station to a site where a siding was available, and to use steam-driven prime-movers.

2.2. On the 29th May, 1927, new plant was commissioned, at the new site and, on 9th September, 1927, the new Power Station was formally opened. The plant installed here consisted of two new 250 K.W. Belliss and Morcom reciprocating sets as well as two 75 K.W. Browett-Lindley sets transferred from the original Power Station, and two Babcock and Wilcox water-tube boilers with an evaporative capacity of 8,800 lbs./hr. each. The supply to the whole town was now on alternating current.

2.3. The history of any electricity undertaking serving a progressive town records continual expansion, so that, with Queenstown falling in this category, it was not long before it was necessary to add more generating plant to that already installed in the Power Station.

2.4. During 1932, two Belliss and Morcom turbo-alternators of a capacity of 1,250 K.W. each were installed, together with two Babcock and Wilcox boilers, and the two 75 K.W. Browett-Lindley sets were disposed of. The boiler plant now consisted of four Babcock and Wilcox water-tube boilers, of a total evaporative capacity of 44,000 lbs./hr. — the evaporative capacity of the two original boilers having been increased to 11,000 lbs./hr. each. These extensions were officially opened on 24th August, 1932; the installed generating plant capacity of the Station now being 3,000 K.W.

2.5. Plans were being made during 1938 for a further extension to be carried out in 1940, but this was delayed by the outbreak of World War II, and the necessary plant was not completed until 1943, when a 3,000 K.W. turbo-alternator, supplied by the British Thomson-Houston Company was commissioned in April. There had, however, been no increase in boiler plant.

2.6. With the continued progress and growth of the town, it became apparent that additional plant would be required in 1950 and, to that effect, preliminaries were started in 1948, when the Consulting Engineer's first report in this connection was presented.

2.7. Post-war difficulties, however, had resulted in longer delivery periods for heavy machinery and, in March, 1950, it became necessary through lack of boiler capacity to place restrictions on the installation of power consuming appliances, such as stoves, motors, etc., throughout the town, in an endeavour to obviate power cuts by keeping peak loads within the capacity of the plant available. In addition, to ease the situation, a Lancashire type boiler with an evaporative capacity of 8,000 lbs./hr., available ex stock in South Africa, was installed in a temporary position outside the boiler house, and commissioned by August, 1951. It was in operation until June, 1953, after which it was disposed of. These restrictions were lifted in November, 1952, for it was anticipated that additional boiler plant would be commissioned early in 1953; this plant was actually only put on range in June, 1953, but fortunately it was never necessary to institute power cuts. The installed capacity of the generating plant was brought up to 9,000 K.W. by the commissioning of a second 3,000 K.W. turbo-alternator in September of 1953.

2.8. With the plant now installed we considered that as far as generating plant was concerned the prudent loading was 6,000 K.W., i.e. allowing for one 3,000 K.W. Unit to be out of commission, but as far as boiler plant was concerned the prudent loading was only 5,280 K.W.

2.9. A review of the situation at this stage revealed that since 1931 the average rate of increase in the annual maximum demand imposed on the Station was slightly in excess of 9% per annum. This fact, in my opinion, establishes a character-

FIGURE 1.

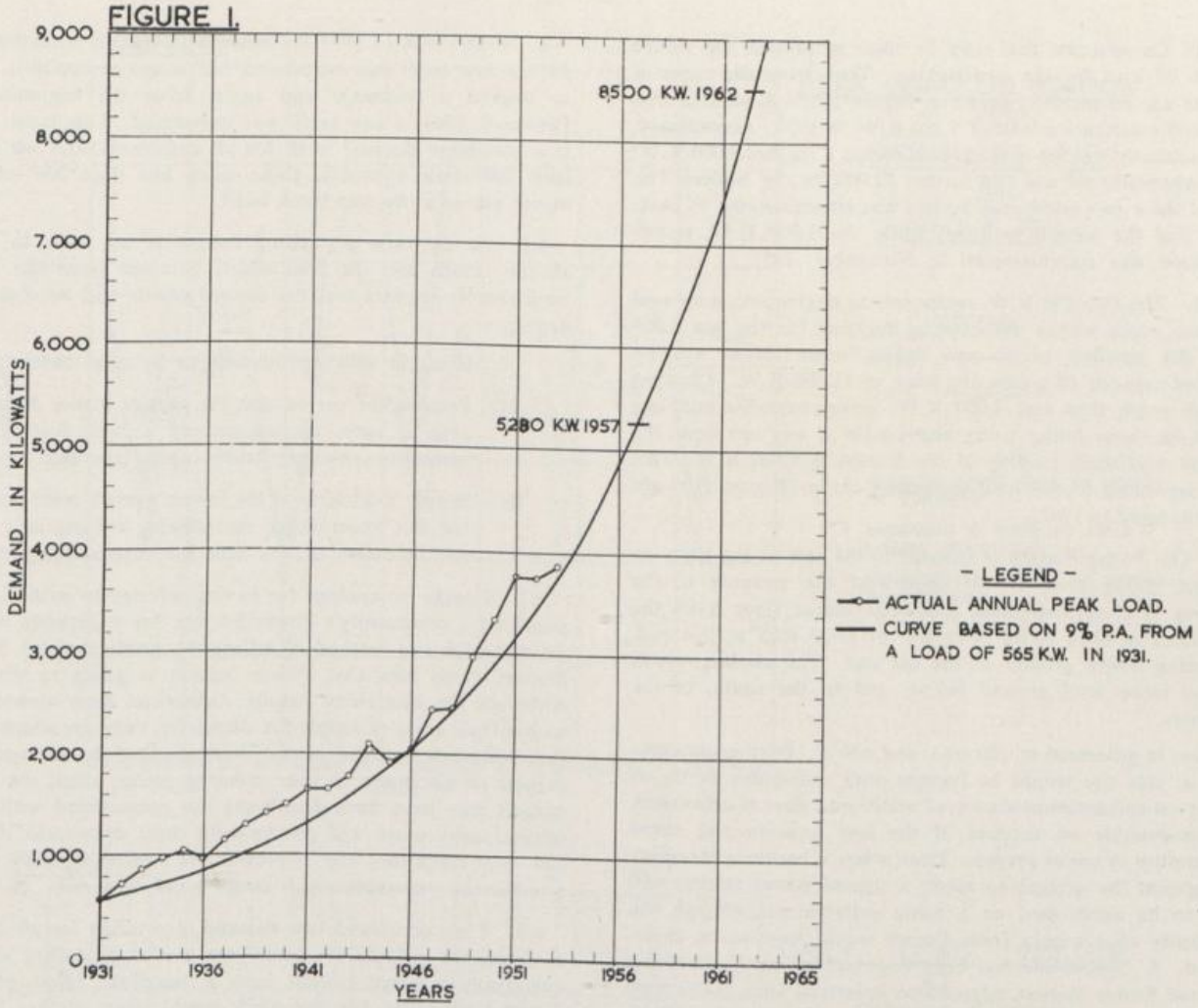
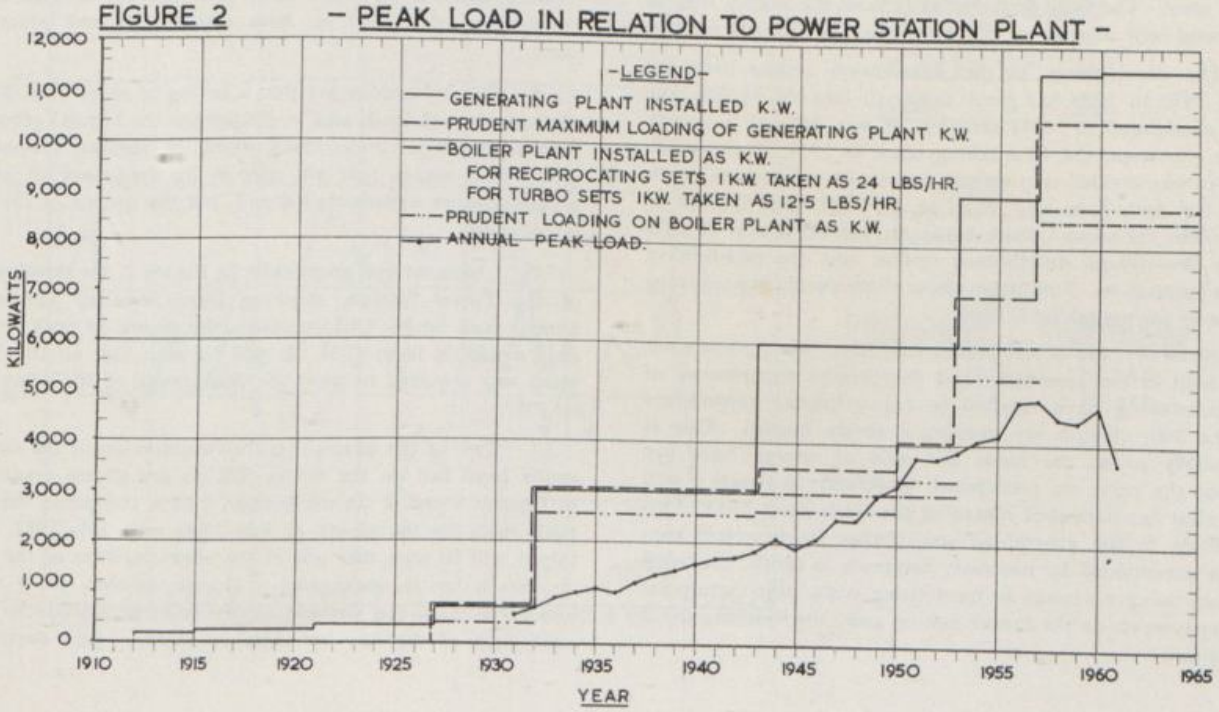


FIGURE 2 - PEAK LOAD IN RELATION TO POWER STATION PLANT -



istic of Queenstown that may be used to predict the future growth of load for the undertaking. Thus from the curve at 9% per annum increase shown in Figure 1, it will be seen that we could anticipate a load of 5,280 K.W. in 1957. Accordingly, the machinery was set in motion to obtain a further 3,000 K.W. turbo-alternator set and two further 22,000 lbs./hr. boilers. The first of these two additional boilers was commissioned in May, 1957, and the second in June, while the 3,000 K.W. turbo-alternator was commissioned in November, 1957.

2.10. The two 250 K.W. reciprocating engine sets were sold to make room within the existing building for the last 3,000 K.W. Set installed, so we now had a Power Station with an installed capacity of generating plant of 11,500 K.W. Allowing for not more than one 3,000 K.W. turbo-alternator and one 22,000 lbs./hour boiler being unavailable at any one time, the prudent maximum loading of the Station is 8,500 K.W. This load, according to our load prediction curve, (Figure 1) might be anticipated in 1962.

3. The Power Station is situated to the east of the town on a slope falling away to the south-east, the entrance to the building is at turbine-house and boiler-house floor level, the basements of both being hewn out of solid rock at this end, but being above ground at the far end. The cooling ponds are on more level ground below, and to the south, of the buildings.

Steam is generated at 220 p.s.i. and 630°F. Further development at this site would be fraught with difficulties as far as the layout and accommodation of additional plant is concerned, and inadvisable on account of the low pressure and steam temperature in use at present. Thus, when it becomes necessary to augment the generating plant, a second power station will have to be established on a more suitable site, though the possibility of a supply from Escom would have to be investigated. A 25-acre site has been reserved by my Council for a second Power Station, adjacent to industrial sites to the west of the town. The final decisions as to how the supply will be augmented will depend on the economics of the alternatives.

4. The development of the distribution system over the period 1932 to 1950 had been slight, so that the system was badly overloaded in many sections. It was decided to rectify this in two steps, the first taking place in 1951/52, in which the town was divided into defined zones with substations established for each zone and supplied at 11,00 volts instead of 3,300 volts; the second phase being the reconstruction of 80% of the low-voltage distribution system and the addition of further substations. This latter phase of the development taking place over the period 1958/1960.

5. Naturally, the developments that have taken place since 1951, both in the generation and distribution departments of the undertaking have resulted in heavy capital expenditure and the loan charges are proving a severe burden. This is particularly so as the loads and sale of energy have not followed the curve we anticipated. Reference to Figure 5 will show what has happened regarding the loads since 1953. This I attribute to the general adverse change in economic conditions, accentuated by necessary increases in tariffs; the tariff increases being necessary to meet rising costs, plus the annual loan repayments on the Power Station and Distribution capital expenditure.

6. From 1938 to 1953 the same tariff was in operation. In 1953 a new tariff was introduced, but it was necessary in 1958 to impose a surcharge and again, from the beginning of February, 1961, a new tariff was introduced. This latter tariff is a maximum demand tariff for all consumers who use more than 200 units a month; those using less than 200 units a month are on a two-step block tariff.

6.1. At the time of writing this, it is too early to show all the results and the final effects obtained from this latest tariff, but it appears that the desired results will be obtained, namely —

I. Bring in sufficient revenue to balance the budget.

II. Prolong the period that the present Power Station is able to serve the community without further augmentation entailing heavy capital charges.

III. Supply electricity at the lowest overall price possible for this undertaking, maintaining a basic unit price not in excess of one cent for most consumers.

6.2. I make no apology for having referred to tariffs in this paper on a community's Power Station, for it depends largely on the price and method of selling the product of the Power Station as to how that Power Station is going to develop. Although the Electricity Supply Authorities have monopolies within their areas of supply for electricity, there are alternatives that will perform most of the functions that the average user expects of electricity, at ever reducing prices, albeit the alternatives may have have drawbacks not encountered with electricity, many users will put up with those drawbacks if they can — or think they can — prevent the outflow of a few cents, whether the inconvenience is really worth it or not.

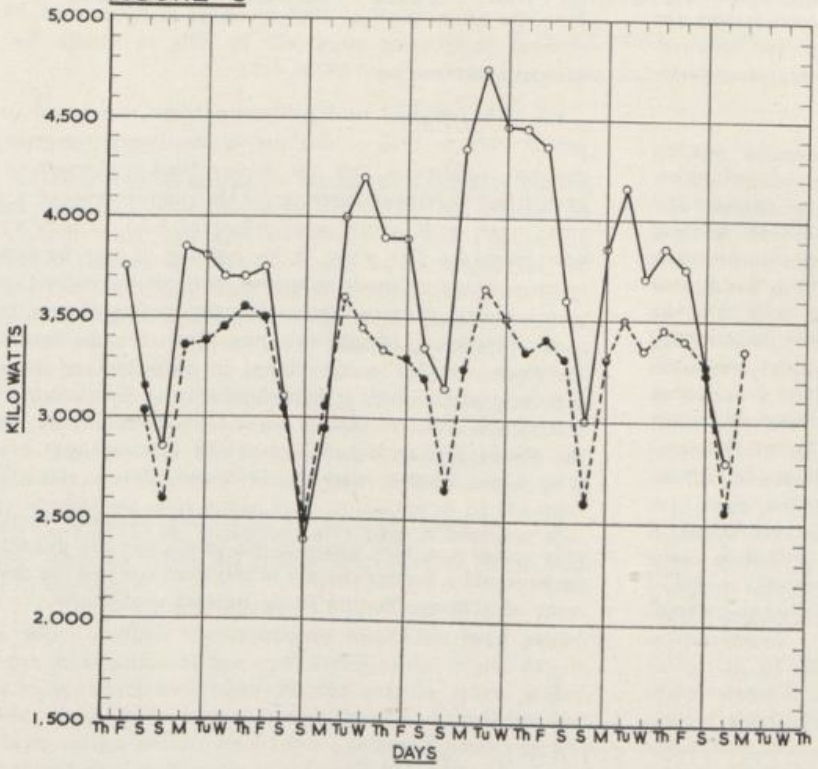
6.3. I am convinced that demand type tariffs for all classes of consumer enforce the intelligent use of electricity and, if universally adopted, would have a beneficial effect on our national economy, for the result would effect savings in the expenditure of capital on both distribution and generation plant.

6.4. The indications are that a saving of more than 20% is effected on peak loads and, consequently, the normal growth of peak loads on an undertaking would be reduced proportionately. This means that not only is the frequency of capital expenditure on expansion reduced, but the output of the asset is enhanced.

7.0. I have set out graphically in Figure 2, the development of the Power Station, showing plant installed against the annual peak loads. Unfortunately, the record of peak loads is only available from 1931. It will be seen that all the boiler plant was required to meet the peak loads of the years 1949 to 1953.

7.1. Two of the effects that the introduction of the demand tariffs have had on the Power Station are shown graphically in Figures 3 and 4. In the former, I have compared the daily peak loads for the month of July 1960, with July 1961. From this it will be seen that one of the characteristics of the loads on the station is undergoing a change, in that, prior to the introduction of the demand tariff, we experienced the main peak load of the day but once or twice a year during the

FIGURE 3



PEAK LOAD ON STATION
FOR
MONTH OF JULY
IN
1960 & 1961

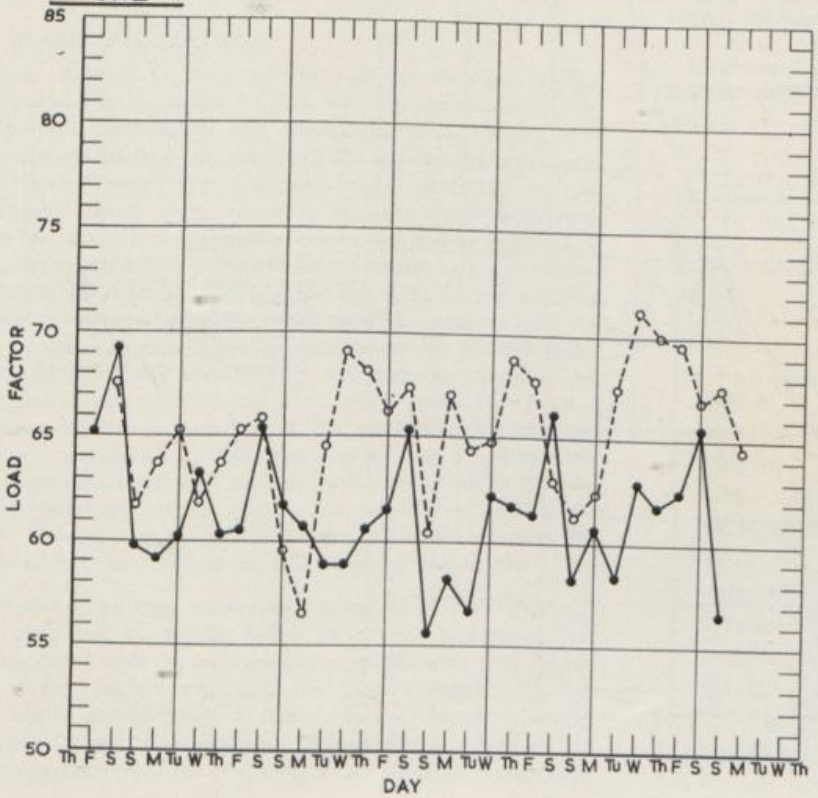
LEGEND

1960 ———

1961 - - - - - - - -

- HIGHEST LOAD FOR 24 HOURS IN EVENING.
- MORNING & EVENING PEAK LOADS IDENTICAL.
- HIGHEST LOAD FOR 24 HOURS IN MORNING.

FIGURE 4.



DAILY LOAD FACTOR
AT
POWER STATION
FOR
MONTH OF JULY
1960 & 1961

LEGEND

1960 ———

1961 - - - - -

	LOAD FACTOR FOR MONTH	AVERAGE DAILY LOAD FACTOR
1960	47·29%	61·28%
1961	57·91%	65·27%

evening, whereas now, the majority of peak loads of the day occur in the evening. In Figure 4, the daily load factors for the month of July in 1960 and 1961 are shown. The improvement shown is gratifying in that it shows the increased beneficial use of the plant on load.

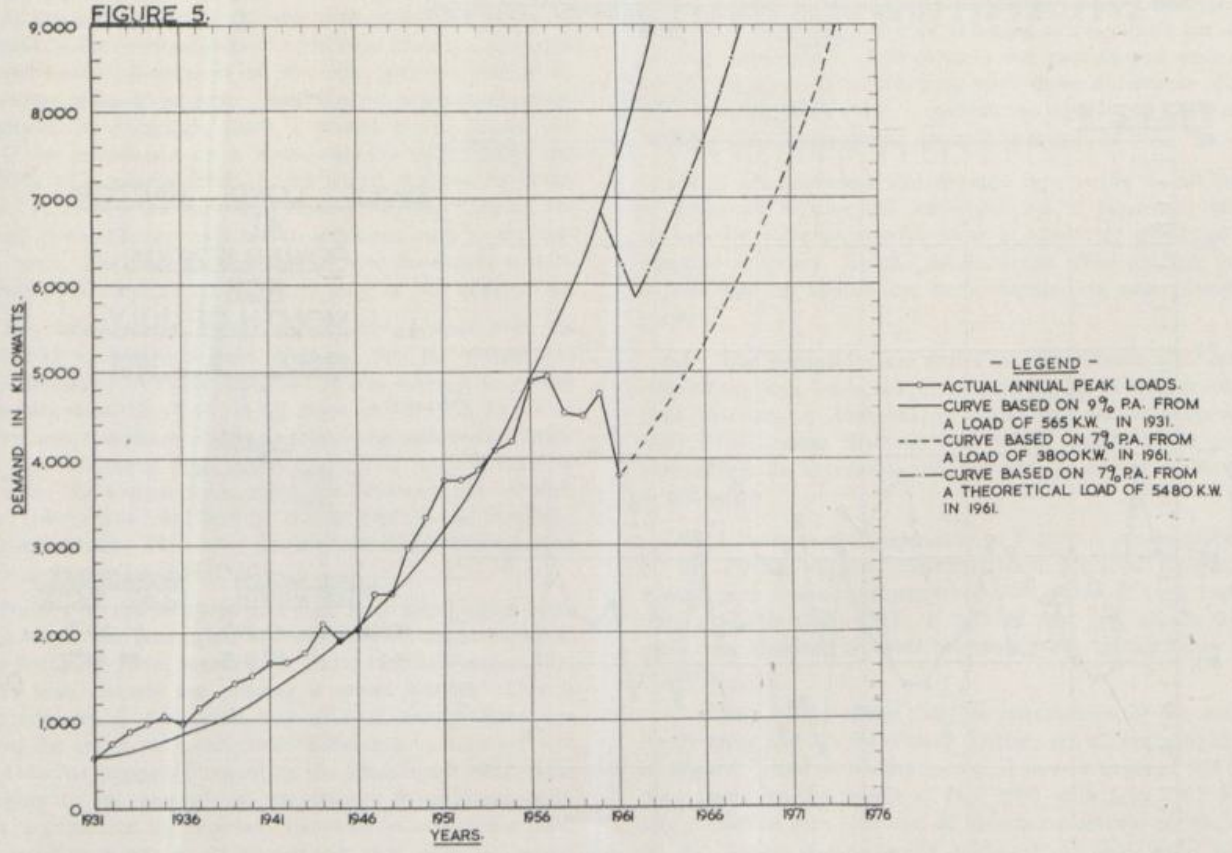
8.0. Figure 5 is my latest load prediction curve and, in addition, it shows what has happened in the period 1953—1961, i.e. since my first prediction curve was produced. The years 1954 to 1956 followed the anticipated growth in load, but then the load fell away sharply for the next three years, recovering slightly in 1960. The fall-off in 1961 was anticipated and caused by the introduction of the demand tariff. On the other hand, if it be conceded that the fall-off in load during the years 1957, 1958, and 1959, were but a temporary recession and that the rise in 1960 was the beginning of a period of recovery which would have resulted in the rate of growth established during the preceding years being attained shortly, then from the time the demand tariff was introduced, adjustments should be made to the original prediction curve, i.e. allow for a drop of 20% for predicted load for 1960 to obtain the estimated load for 1961, and plot a new prediction curve from this point at 7% per annum. We then find that the plant in the Power Station should take care of the load until 1968.

8.1. Examination of Figure 5 will show that if the load from the actual peak of 1961 increases at the rate of 7% per annum, the existing plant will be able to handle the load without assistance until 1973—1974.

8.2. The original load prediction curve was based on the period 1931 to 1953 — this period saw depression, war, and post-war conditions, but the Power Station throughout this period had only been catering for the requirements of a small rural town with hardly any industrial load. The town has now reached a size when, in my opinion, it may be expected to start attracting small industries, particularly if the Government's policy of decentralising industry and developing border areas is persued. Should this take place then the loading on the Power Station would change in character and we could expect an altered rate of load development. Considering these facts, therefore, I would not be at all surprised if the load on the Power Station did not reach the prudent limit of 8500 K.W. about midway between 1968 and 1974 — say 1971.

8.3. At some time in the future my successor should be able to tell you how accurate this prediction has proved, and perhaps add a further chapter to this brief story of the development of a Power Station in an isolated community.

FIGURE 5.



Load Factor and Consumer Maximum Demand

By M. P. B. CLARKE, B.Sc.(Eng.)
Town Electrical Engineer, Somerset East.

1. INTRODUCTION.

In common with most smaller Municipal Electricity Undertakings, Somerset East has experienced periods during its development when shortages of generating and distributing plant have resulted in difficulties and inconvenience for the consumers of electricity, and loss of revenue for the Undertaking. One such period was the winter of 1954, when rationing of electricity was resorted to on a large scale in order to reduce the system peak loads to the limits imposed by generating plant capacities. Coupled with the necessity for revising the then inadequate and uneconomic tariffs which existed, this proved to be a suitable time to give practical consideration to the introduction of a maximum demand type of tariff, which, as a means of reducing peak loads, was considered to be the most suitable method for the conditions obtaining in Somerset East and that likely to induce the greatest improvement to the load factor of the system.

The paper outlines the experience which has been gained since the introduction of this tariff and goes on to give details of the results which have been obtained over the years. Where possible, results have been collected from Undertakings that have been using a similar tariff for a number of years and, the whole question of load factor is discussed in an effort to focus attention to what is undoubtedly a subject of vital importance to all attending the Convention.

2. PLANT UTILIZATION.

It is difficult to imagine what our civilisation of mid twentieth century would be like without the machines and mechanical contrivances that make our modern living conditions a reality, and yet, outside of the engineering profession, men and women pay amazingly scant attention to the machinery which they encounter in their day-to-day-living. In a few cases, and the modern motor car can be included in this, the machines are treated to some thought as far as routine maintenance is concerned, but for the most part a machine is looked upon as something that would be nice to have for this or that purpose, or, that is put into service when required for some particular operation — and pity the machine that does not operate satisfactorily when called upon! One point is certain and that is, very few of the mechanical contrivances that are purchased by men and women are acquired after thorough examination of the real usefulness to which the particular machine can be put; to the majority of people far more thought is given to the problem of how to finance the transaction than to the basic economics of the matter.

Engineers, be they mechanical, electrical or civil engineers and employed by public bodies or private enterprises, are always faced with the twin problems of efficiency and finance and so the acquisition of machines has always been a matter for careful consideration to them. In the electricity supply industry in particular engineers pay careful attention to the proper utilisation of the costly plant and machines under their control, but whether this has been given all the attention which the subject deserves is a matter of opinion. Certainly, a fundamental term has been defined and brought into general use for gauging the extent of this utilisation, and, it is also certain that engineers apprehensively calculate system load factor at the end of each year and are greatly pleased if it is increased, and dismayed if it is decreased, compared with the previous performance of their particular undertaking. Furthermore, there are those who have pursued one or more of the accepted methods of reducing peak loads and applied them to their particular system; that these are not more extensively applied is proof enough that much thought and time must still be given to this problem.

Clearly, in an industry requiring a capital investment of the order of R15-00 per rand of income, from the sale of electricity — compared with an income sometimes as much as R45 for the same investment in most commercial and industrial establishments—there is every need for concern with improved utilisation of plant and equipment for, not only does the improvement in load factor mean the deferment of the installation of extra plant and the capital expenditure involved, but also, there is a direct effect on the economy of the Undertaking. Higher load factors are synonymous with higher off-peak loads, this in turn means higher efficiency of conversion in generating plant and the consequent overall improvement in energy and production costs.

In discussing the Nationalised Electricity Industry in Great Britain, Kelf-Cohen[1] expresses himself very strongly in this matter.

	ELECTRICITY LOAD FACTOR	
	(1) Based on maximum demand supplied.	(2) Based on estimated maximum potential demand.
1947/8	48.4	45.8
1948/9	49.4	47.3
1949/50	48.1	43.1
1950/51	52.5	45.0
1951/52	51.3	47.6
1952/53	49.0	45.1
1953/54	46.3	43.8
1954/55	48.2	46.3
1955/56	48.1	44.4
1956/57	47.9	—

TABLE 1: Load Factors on the Central Electricity Authority British Grid System.

Discussing load factor on the British grid system (Table 1) he makes the following comments:

> ". . . . looking at the 10 years figures, one cannot resist the conclusion that since nationalisation nothing has happened to the load factor; if anything it is worse than ten years ago . . . ."

and he follows by saying:

> "Electrical Engineers are anxious to use the most efficient stations and classify them most scrupulously . . . But to search for ways and means to maximise the use of the vast plant under their care does not seem to concern them. To do so would require some unorthodox thinking and departure from tradition. There would have to be some drastic modifications in tariffs; all this would not be easy and rather unpopular in the industry."

He reasons that with the vast capital expenditure involved in the British Electricity System the load factor, which has remained sensibly constant at about 50%, should have attracted much more attention than it has.

And yet, in a published report of the British Supply Industry (2) in 1952 there is specific reference to the research then being done to eliminate or minimise the poor load factor on the grid system; the results as far as can be judged from Table 1 are not encouraging.

On the other hand, American Utilities seem to be in a somewhat better position and load factors of the order of 60% are usual.(3)

The published statistics for South African Electricity Undertakings are not particularly encouraging when viewed overall; the latest(4) published figures for the five largest municipal undertakings show the highest load factor to be 56.3% and the lowest 43.1%. Only five of the 320 odd municipal undertakings in Southern Africa have load factors of 60% or higher and about 250 have load factors below 50%.

Statistics for the generating stations on the Electricity Supply Commission's network are considerably better than those on our municipal systems and figures of 70% are produced.

3. CONDITIONS AFFECTING THE UNTILIZATION OF PLANT.

It has been said that man is a creature of habit; for better or for worse we live within the broadly defined limits of our habits. The division of our day between wakefulness and sleeping, working and playing, sets into motion a chain of circumstances and conditions which have a bearing on the utilisation of the plant and machines which provide the requirements of our living. Geographic and climatic conditions and domestic and national characteristics all combine to play their part in affecting the load factor of electricity supply systems; in America it was found that the extensive use of refrigeration plant and air-conditioning equipment, and the absence of electrical space heating load, materially assists in improving the load factor on the electrical utilities.

The trend to shorter working hours in commerce and industry and the greater use of higher electrical loadings in electrical appliances combine to minimise the use of installed equipment in electrical systems, while the improvement to be obtained by supplying industrial loads using the three-shift system of working can hardly be more graphically shown than by the figures mentioned above for the E.S.C. stations. These stations benefit from the large mining loads which are supplied from the network and, from the fact that on a large integrated network the diversity between groups of consumers is improved by geographic considerations.

This phenomenon of diversity between the loads of groups of consumers has very recently been taken to its logical conclusion to the benefit of the supply networks concerned, with the commissioning of the cross-channel cable link between Britain and France. But, while these conditions contribute to the better utilisation of generating plant, one must not lose sight of the fact that poor load factor on individual sections of an integrated network of this type may well exist and, that quite large items of distribution plant or equipment can be found on these systems for which the extent of utilisation leaves much to be desired.

Whether the natural diversity between consumers or groups of consumers that already exists, or which will develop by virtue of the more diverse use of electrical equipment of all kinds, can keep abreast of the downward trend in load factor caused by higher loadings of that equipment and by the influence of the equipment on our standard of living, as more and more electricity is consumed, is clearly a matter for speculation.

4. IMPROVEMENT OF LOAD FACTOR.

Any effort to make better use of the plant in an electricity supply undertaking must necessarily take into consideration that, firstly, there must be an improvement in the load factor of the individual consumers being supplied and secondly, either as an alternate to this or complementary to it, there must be greater diversity between the peak loads of these consumers. If a system of peak load control is applied to a group of consumers then clearly the load factor of the group will improve — and in general this is desirable and economically advantageous to the group — but obviously there will be sections of the network and individual items of equipment where the utilisation has not improved to the same extent. Systems are in use in which portions of the load of individual consumers is remotely switched to suit load conditions on the system as a whole; others again rely on the structure of tariffs to induce consumers to reduce individual peak loads, in either case an improvement in the load factor of the individual consumers results and there is an overall improvement to the systems.

Clearly, as the load factor of individual consumers increases there is a reduction in the diversity between their peak loads and therefore, while specific items or portions of plant and equipment may be utilised more fully it is possible, at least theoretically, that there will be no improvement at the central supply point. That an overall improvement does take place was clearly illustrated in a paper read to the Convention at Livingstone, in which a description was given of the application of audio-frequency remote control on a distribution network. The paper made mention of one of the alternative

methods of load control namely, the use of multiple tariff metering, and it is to this method that attention is now turned.

5. MULTIPLE TARIFF METERING.

For many years it has been accepted practice to use two or three-part tariffs as the basis of charges for electricity supplied to large power users. Whether this was motivated by a desire to improve the load factor of the system or merely to recover the costs of supplying the power in the most equitable way is not relevant; the fact is that the introduction of maximum-demand type tariffs provides the incentive for a consumer to reduce peak loads. The extent to which a reduction will be achieved will depend as much on the use to which the power is being put as on the relative cost of the "demand" portion of the tariff when compared with the tariff as a whole. The high cost of M.D. metering equipment has largely prevented this type of tariff being applied to the smaller individual consumers but the advent of more competitively priced demand meters and the introduction of miniature circuit breakers have undoubtedly assisted the introduction of these tariffs.

Some two-thirds of the energy supplied by our Municipal Undertakings is to domestic consumers and it is therefore obvious that a suitably designed M.D. tariff for smaller consumers must be of real value in improving the utilisation of plant on our systems. Of the 320 municipal electricity undertakings listed in Southern Africa there are now 18 using multiple tariff metering in one form or another for their smaller consumers; five years ago there were only four. That the introduction of miniature circuit breakers has assisted in promoting this type of tariff can be gauged from the fact that 12 of the 18 use these as the basis of their tariffs. No doubt the controversy "circuit breakers vs. ammeters" will continue for many years but an essential feature to either of these devices is that they can only succeed in the function of improving consumer load factor if the correct balance is maintained between the consumer's "demand" costs and his "energy" costs. It is obvious that a disproportionately small demand charge will provide little or no incentive for a consumer to reduce his peak load and therefore to improve his load factor, and that he will be content to pay that little extra in demand charge which may be necessary to ensure his continued unfettered used of the commodity.

Contrary to widely held beliefs the introduction of multiple tariff metering to smaller consumers is neither difficult nor particularly involved and within a matter of weeks the consumers adapt themselves to the changed conditions. As far as domestic consumers are concerned some difficulty arises in those installations using the modern heavy-loading electric stoves but even in these cases the sum of the loading of the oven and one plate can generally be maintained as the upper limit of the consumer's demand. In Somerset East one of the most widely adopted practices that was resorted to by domestic consumers, was to switch off the water heater as soon as the stove was required; in some cases the consumer was inconvenienced by a shortage of hot water, having forgotten to switch on again, but it is now possible to effect both of these operations automatically with a relatively inexpensive relay connected in the stove circuit.

6. RESULTS OBTAINED.

Table 2 shows the annual load factor of four towns in which some form of multiple tariff metering has been in use during the past five years. While each case shows clearly that there has been an improvement in load factor, it is important to realise that the loading on these networks is of a very mixed type; not only is there industrial and commercial load in varying amounts, but also, the domestic consumers other large numbers. Certainly in Somerset East, where only approximately one-third of the domestic consumers fall into the "all-electric" category, the improvement in system load factor has been contributed to by the development of various additional loads as well as by the introduction of the multiple tariff metering system.

On account of this, and in an effort to establish the extent of the improvement in the utilisation of equipment on the distribution network in those areas in which the load is predominantly domestic, since the introduction of multiple tariff metering, tests were carried out on selected feeders which supplied more or less exclusively domestic consumers having all-electric installations.

Table 3 shows the results obtained from these investigations. It should be noted that the Somerset East tariffs are based on the use of miniature circuit breakers and that figures for installed demand per consumer are readily obtainable. Also, the measured After Diversity Maximum Demands which are shown are those recorded during peak conditions in the winter period.

	ANNUAL LOAD FACTOR %									DOMESTIC CHARGE c/amp.
	1951	1952	1953	1954	1955	1956	1957	1958	1959	
OUDTSHOORN			34.0	34.1	**41.8**	41.8	42.5	41.8	43.5	13
SOMERSET EAST			28.9	31.8	**38.0**	37.0	42.4	45.3	44.6	30
WALMER			29.4	**29.0**	32.8	32.6	31.5	31.7	31.8	10
WINDHOEK	41.7	42.0	**48.9**	43.6	44.2	47.5	44.3	44.6	46.6	15

TABLE 2: Annual load factors for various undertakings.

Note: (i) **41.8** indicates introduction of M. T. metering.

(ii) Domestic maximum demand charges in cents per ampere from published figures for 1960/61.

FEEDER	NO. OF CONSUMERS ON FEEDER	AVERAGE INSTALLED DEMAND AMPS/CONS.	CALCULATED KVA/ CONSUMER	MEASURED A.D.M.D. KVA/ CONSUMER	AVERAGE ANNUAL CONSUMPTION UNITS/CONS.
A	8	17.2	3.79	1.87	5,172
B	29	12.9	2.34	1.64	4,464
C	25	16.6	3.65	2.36	6,360

TABLE 3: Summary of consumer statistics.

From the table it will be observed that Feeder B has an average installed demand per consumer (12.9 amps) which is quite considerably lower than either Feeders A or C. All 29 consumers supplied from this feeder live in a Municipal housing scheme and these consumers fall into the "middle" or "lower-middle" income group; in the case of the other feeders the consumers can best be classified in the "middle" and "upper" income groups. The figures for the average annual consumption per consumer also give some guide to the nature of the consumers in each of the particular areas.

One has only to page through copies of the Proceedings of this Association to appreciate that A.D.M.D.'s of the same order as those shown in Table 3 are seldom attained; in fact some of the lowest will be noted in the 1959 proceedings, in the discussion on a paper based on reticulation in Montgomery Park, Johannesburg, where, in one area in Ladysmith, Natal, figures of 2.5 to 3.5 kW have been obtained with the use of load limiters.

During the five year period 1955 to 1959 the sales of electricity on the Somerset East system increased at an average rate of about 11% per annum and the sales for domestic purposes 3.7% per annum. The fairly high rate for the increase in total sales is due in part to expansion of the system into new areas of supply while the increase in the use of electricity for domestic purposes is almost entirely due to greater usage by existing consumers and the conversion of non-electric cooking and heating installations. There will be many engineers present who are acutely aware that the cost of running all-electric domestic installations in our smaller towns is considerably higher than that in the larger centres, and, that, as a consequence, the alternate forms of heating and cooking find a ready market. In this regard it is particularly interesting to record that the heavily insulated, continuous-burning, anthracite-fuelled cookers have enjoyed great popularity for many years and this, in spite of their initial cost.

7. CONCLUSION.

Electricity supply is an industry in which plant and equipment are available for almost continuous use; it is one in which the raw materials required for the generation of power — in the case of steam plant in South Africa — run to an annual expenditure of the order of two-thirds of that required to meet the charges for the loans which are required to acquire this plant. There is therefore a strong case to be made for developing ways and means to improve the utilisation of this equipment to the advantage of all, on an individual and a national level.

There can be no denying that developments have gradually taken place over the years, and, that methods have been evolved for the reduction of peak loads and the improvement of load factors, but if the issue is to be faced squarely it must be acknowledged that there is much room for improvement. Individual consumers should have greater incentives for improving the load factors of their own installations whether small or large, and in this respect engineers in the supply undertakings must take the lead.

Clearly, if the consumers of electricity have need for appliances or machines which have higher load factors in themselves or, in conjunction with other equipment within their installations, the suppliers and manufacturers of this equipment will develop ways and means of meeting this requirement.

From the experience and the results which have been obtained in Somerset East, I have no doubt that the development of a low loading continuously energised electric cooker would materially benefit electricity distribution networks and, in those cases — as in Somerset East — where the domestic peak overlaps the commercial and industrial peak, the load factor of the undertakings. These benefits, along with that obtained by the greater use of thermal storage space heating equipment and other "off-peak" consuming devices must reflect advantageously in the economy of the communities being served and justify a bolder and more imaginative approach to the problem, than that which has existed in the past.

In conclusion, it is hoped that this paper will assist those engineers who may have been contemplating various methods of load factor improvement but who have been unable to decide on the method, or combination of methods, most suited to their particular system requirements, and, I would like to record my thanks to the Municipal Council of Somerset East for affording me the opportunity of presenting this paper to the Association and to my friends and colleagues for their encouragement and assistance in its preparation.

8. BIBLIOGRAPHY.

(1) Nationalisation in Britain — The End of a Dogma: Kelf Cohen.

(2) The British Electricity System — U.S. Productivity Team Report: British Productivity Council.

(3) Productivity Report — Electricity Supply in U.S.A.: Anglo American Council of Productivity.

(4) Official S.A. Municipal Year Book: S.A. Association of Municipal Employees.

Annual Report of the Secreraries

To the President and Members of the Association,

Mr. President, Gentlemen,

It gives me great pleasure to submit to you the Annual Report of your Association together with the Revenue and Expenditure Account and Balance Sheet for the financial year ended 28th February, 1962.

OBITUARY :

I deeply regret having to record the passing of Members and others who have been connected with the Association.

Firstly, I wish to refer to the passing of Mr. Andrew Taylor who occupied the position of Secretary of our Association from December, 1945, to 30th June, 1955. Mr. Taylor joined the Electricity Department, Johannesburg in 1902 and rose to the position of Chief Clerk. He retired in September, 1945. He saw active service during the First World War from August, 1915 to April, 1919.

In the passing of Mr. Arthur Rodwell, the Association has lost one of its best known and beloved characters. Mr. Rodwell was President of the Association in the years 1936/7 and 1944/5 having joined the Association in 1924. He was appointed an Honorary Member in 1945. Mr. Rodwell was born in England in 1884 and immigrated to South Africa in 1906 where he joined the Johannesburg Electricity Department. He retired from the position of General Manager of the Electricity Department of that City in 1944, having held the position since 1930.

Another Engineer Member of the Association, Mr. G. A. H. Schaftenaar of Graaff-Reinet, also passed away during the year under review.

THIRTY-FIFTH CONVENTION :

The 35th Convention of the Association was held in Livingstone from Monday, 1st May, 1961. Delegates were welcomed to Livingstone by His Worship the Mayor, Councillor Slutzken. A welcome was extended to the Convention by the representative of the City Council of Germiston, Councillor C. R. Paintin. The Convention Proceedings were officially opened by the Hon. G. W. R. l'Ange, C.B.E., M.P., Federal Minister of Works. The total attendance of members, delegates, representatives, officials, visitors and ladies numbered 353.

On behalf of the President, members of the Association and all others who attended the Convention, I have pleasure in recording appreciation to His Worship the Mayor and Town Councillors of Livingstone for the hospitality extended by them. I also wish to extend sincere thanks to Mr. W. Beesley and other officials of the Municipality for their unstinted assistance in the organisation of the Convention. It is also my pleasure to record the appreciation of all concerned for the assistance and support given by the City Council of Germiston to the Convention. To the President, I have much pleasure in placing on record the appreciation of all concerned for his efficient and pleasant discharge of his duties.

Jaarverslag van die Sekretarisse

Aan die Voorsitter en Lede van die Vereniging,

Meneer die Voorsitter en here,

Dit verskaf my groot genoeë om aan u die Jaarverslag van u Vereniging tesame met die Inkomste- en Uitgawerekeninge en Balansstaat vir die boekjaar geëindig 28 Februarie 1962 voor te lê.

STERFKENNIS :

Met groot leedwese moet ek melding maak van die heengaan van lede en ander wie aan die Vereniging verbonde was.

Eerstens wil ek die afsterwe meld van Mnr. Andrew Taylor wie die betrekking van Sekretaris van ons Vereniging beklee het vanaf Desember 1945 tot Junie 1955. Mnr. Taylor het by die Johannesburgse Elektrisiteitsdepartement aangesluit in 1902 en gevorder tot die posisie van hoofklerk. Hy het in September 1945 afgetree. Gedurende die Eerste Wêreldoorlog het hy aktiewe diens gedoen vanaf Augustus 1915 tot April 1919.

Met die heengaan van Mnr. Arthur Rodwell het die Vereniging een vay sy bes bekende en mees beminde karakters verloor. Gedurende die jare 1936/7 en 1944/5 was Mnr. Rodwell Voorsitter van die Vereniging nadat hy in 1924 by die Vereniging aangesluit het. In 1945 is hy as Erelid aangestel. Mnr. Rodwell is in 1884 in Engeland gebore en het na Suid-Afrika emigreer in 1906 en by die Johannesburgse Elektrisiteitsdepartement aangesluit. In 1944 het hy as Algemene Bestuurder van die Elektrisiteitsdepartement van daardie stad afgetree nadat hy daardie posisie sedert 1930 beklee het.

Nog 'n Ingenieurlid van die Vereniging, Mnr. G. A. H. Schaftenaar van Graaff-Reinet is gedurende die jaar onder oorsig oorlede.

VYF-EN-DERTIGSTE KONVENSIE :

Die 35ste konvensie van die Vereniging is gehou in Livingstone vanaf Maandag 1 Mei tot Donderdag 4 Mei 1961. Afgevaardigdes is in Livingstone verwelkom deur Sy Edele die Burgermeester, Raadslid Slutzken. Woorde van verwelkoming is aan die konvensie gerig deur die verteenwoordiger van die Stadsraad van Germiston, Raadslid C. R. Paintin. Die konvensie is amptelik geopen deur Sy Edele G. W. R. L'Ange, C.B.E., L.V., Federale Minister van Werke. Die totale opkoms van lede, afgevaardigdes, Verteenwoordigers, besoekers en dames het 353 beloop.

Namens die Voorsitter, lede van die Vereniging en alle ander persone wat die konvensie bygewoon het wens ek met genoeë ons waardering uit te spreek teenoor S.E. die Burgemeester en Raadslede van Livingstone vir die gasvryheid van hulle ontvang. Aan Mnr. W. Beesley en ander amptenare van die Munisipaliteit ook ons opregte dank vir hulle oorvloedige hulp by die organisasie van die Konvensie. Met genoeë wil ek ook die waardering van alle betrokkenes aanteken vir die hulp en bystand deur die Stadsraad van Germiston aan die konvensie verleen. Teenoor ons Voorsitter wil ek ook graag die waardering van ons almal uitspreek vir die doeltreffende

Our grateful thanks are also extended to Mrs. Lombard for her support and with her name I wish to couple that of Mrs. Beesley.

A highlight of the Convention was the visit by practically everyone present to the Kariba Power Station and our grateful thanks are extended to the Chairman and members of the Federal Power Board who together with members of their staff made the visits possible.

The Papers presented to the Convention dealt, to a great extent, with Hydro Electric generation. Those dealing with this aspect were "The Kariba Project" by Mr. G. R. Peterson, B.A., M.I.E.E., M.I.Mech.E., M.Rhod.I.E. and "The Utilisation of Hydro Electric Power in the Union of South Africa", by Mr. C. E. R. Langford, M.I.E.E., M.(S.A.)I.E.E. These Papers proved to be of outstanding interest. The Paper "Supervisory Remote Control of a Distribution System" by E. Brod, Dipl. Ing., A.M.I.E.E., which dealt with the system adopted by the City of Salisbury, was of practical interest and brought forth instructive discussion. The Paper "The Application of 'Audiofrequency' Remote Control on an Electricity Supply Undertaking's Distribution Network" by J. K. von Ahlften, B.Sc., B.Sc. (Eng.) resulted in animated discussion of a most informative nature. The high standard of Members' Forum was again well maintained and our thanks are again extended to Mr. J. Mitchell for conducting the Forum. In my previous report, I referred to the fact that arising from the Forum at the 34th Convention, the Executive Council considered the possibility of giving greater opportunity for a discussion on the economic aspects of Municipal Electricity Undertakings. It will be noted that by the choice of Papers to be presented at the 36th Convention, this suggestion has been given effect to.

It was unanimously agreed to accept the invitation of East London to hold the 36th Convention in that city.

MEMBERSHIP :

The following new members were elected during the year ended 28th February, 1962:

Councillor Members :

Viljoenskroon Municipality.
Bedfordview Village Council.

Engineer Members :

W. F. Ploos-Van Amstel (Viljoenskroon).
G. D. Wiehahn (Bethlehem).
A. C. T. Franz (Cape Town).
W. P. Rattey (Orkney).

Associate Members :

J. A. Magowan (S.R. Electricity Supply Commission).

Affiliates :

Lodge Cottrell (Africa) (Pty.) Ltd.
Farad (Pty.) Ltd.

The following resignations took place:

Councillor Members :

Gwelo Municipality.

en vriendelike wyse waarop hy sy pligte uitgevoer het. Ons dank ook aan Mev. Lombard vir haar hulp en saam met haar naam wil ek ook dié van Mev. Beesley noem.

'n Glanspunt van die konvensie was die besoek deur feitlik almal teenwoordig aan die Kariba kragstasie en aan die Voorsitter en Lede van die Federale Kragraad wie in samewerking met lede van hulle personeel die besoek moontlik gemaak het gaan ons hartlike dank.

Verhandelinge wat by die Konvensie aangebied is het grotendeels gegaan oor hidro-elektriese kragopwekking. Die wat oor hierdie aspek gehandel het was „The Kariba Project" deur Mnr. G. R. Peterson, B.A., M.I.E.E., M.I.Mech.E., M.Rhod.I.E. en „The Utilisation of Hydro-Electric Power in the Union of South Africa" deur Mnr. C. E. R. Langford, M.I.E.E., M.(S.A.)I.E.E. Hierdie lesings was van uitstaande belang. Die verhandeling „Supervisory Remote Control of a Distribution System" deur Mnr. E. Brod, Dip. Ing., A.M.I.E.E., wat gegaan het oor die stelsel aanvaar deur die Stad Salisbury was van praktiese belang en het leersame bespreking uitgelok. Die verhandeling „The Application of Audiofrequency Remote Control on an Electricity Supply Undertaking's Distribution Network" deur J. K. von Ahlften, B.Sc., B.Sc.(Ing.) het 'n lewendige bespreking van baie leersame aard uitgelok. Die hoë standaard van die Ledeforum is weer goed gehandhaaf en ons dank gaan weereens aan Mnr. J. Mitchell vir sy bestuur daarvan. In my vorige verslag het ek gewag gemaak van die feit dat, voortspruitende uit die Forum by die 34ste konvensie, die Uitvoerende Raad die raadsaamheid van 'n beter geleentheid vir besprekings oor die ekonomiese aspekte van Munisipale elektrisiteitsondernemings oorweeg het. Opgemerk sal word dat aan hierdie voorstel uitvoering gegee is by die keuse van verhandelings wat by die 36ste konvensie aangebied sal word.

Daar is eenparig besluit om die uitnodiging van Oos Londen om die 36st konvensie aldaar te hou te aanvaar.

LIDMAATSKAP :

Die volgende nuwe lede is gedurende die jaar geëindig 28 Februarie 1962 verkies:

Raad Lede :

Viljoenskroon Munisipaliteit.
Berdfordview Dorpsraad.

Ingenieurlede :

W. F. Ploos-van Amstel (Viljoenskroon).
G. D. Wiehahn (Bethlehem).
A. C. T. Franz (Kaapstad).
W. P. Rattey (Orkney).

Deelgenootslede :

J. A. Magowan (S.R. Elektrisiteitesvoorsieningskommissie).

Geaffilieerdes :

Lodge Cottrell (Afrika) (Edms.) Bpk.
Farad (Edms.) Bpk.

Die volgende bedankings is ontvang:

Raad Lede :

Gwelo Munisipaliteit.

Affiliates :

Aberdare Construction (Pty.) Ltd.

Morganite S.A. (Pty.) Ltd.

Associate Member :

Mr. A. B. Cowen (S.R. Electricity Supply Commission).

Comparative membership figures are as follows:

	1960/61	1961/62
Councillor Members	124	125
Engineer Members	118	122
Honorary Members	13	13
Associate Members	29	29
Associates	10	10
Affiliates	85	85

FINANCE :

The Income and Expenditure Account for the year under review and the Balance Sheet as at 28th February, 1962, which are submitted to you reflect an excess of income over expenditure for the year, of R457.00 (£228). The Accumulated Funds of the Association now stand at R9,377.00 (£4,688), which we consider a satisfactory position.

Messrs. Kane and Downey continued to constitute the Finance Committee for the Association during the year under review and once again, I thank them sincerely for their assistance. The support of the advertisers in the Proceedings is once again acknowledged with appreciation.

EXECUTIVE COUNCIL :

During the year under review following their resignation from their respective undertakings, two members of the Executive Council tendered their resignations. The members concerned were Messrs. J. E. Mitchell and J. L. van der Walt. The appreciation of the Association to these gentlemen for their services will be conveyed to them in Convention at an appropriate time but, at this stage, I wish to place on record our very sincere thanks to them for their support in the past and also to convey our best wishes to them in their new spheres.

REGIONAL BRANCHES :

The Regional Branches in the Eastern Cape and Natal continued to function satisfactorily during the year under review.

MID-YEAR EXECUTIVE MEETING :

Germiston acted as host for the Mid-Year Executive Meeting in 1961. On behalf of all concerned, we convey thanks to His Worship the Mayor and Councillors of that city for the hospitality extended on that occasion.

SUB-COMMITTEES AND REPRESENTATIVES :

Once again it is our pleasure to convey the appreciation of the Association to members of the various Sub-Committees as well as Representatives to other Technical Committees and Organisations for their invaluable work on behalf of member undertakings during the year under review.

To you, Mr. President and all Members of the Executive Council I express sincere thanks for the assistance and courtesy extended to us during the past year.

To the Association and all its Members we extend best wishes for 1962/3.

R. G. EWING,
for Davidson & Ewing (Pty.) Ltd.
Secretaries.

15th March, 1962.

Geaffilieerdes :

Aberdare Construction (Edms.) Bpk.

Morganite S.A. (Edms.) Bpk.

Deelgenootslede :

Mnr. A. B. Cowen (S.R. Elektrisiteitsvoorsieningskommissie).

Vergelykende lidmaatskapsyfers is as volg:

	1960/61	1961/62
Raad Lede	124	125
Ingenieurlede	118	122
Erelede	13	13
Deelgenootslede	29	29
Deelgenote	10	10
Geaffilieerdes	85	85

FINANSIES :

Die Inkomste- en Uitgawerekeninge vir die jaar onder oorsig en die Balansstaat soos op 28 Februarie 1962 wat aan u voorgelê word weerspieël 'n oorskot van inkomste oor uitgawes vir die jaar van R457.00 (£228). Die Opgehoopte Fondse van die Vereniging staan tans op R9,377.00 (£4,688) wat ons as 'n bevredigende posisie beskou.

Mnre. Kane en Downey het aangehou dien as die Finansiële Komitee van die Vereniging vir die jaar onder bespreking en ek wil my opregte dank aan hulle betuig vir hulle bystand. Die ondersteuning van adverteerders in „Proceedings" word weereens met waardering erken.

UITVOERENDE RAAD :

Gedurende die jaar onder bespreking het twee lede hulle bedankings ingedien as gevolg van hulle bedankings uit hulle respektiewe ondernemings. Die betrokke lede was Mnre J. E. Mitchell en J. L. van der Walt. Die Vereniging se waardering aan hierdie twee here vir hulle dienste sal op 'n gepaste tyd in konvensie aan hulle oorgedra word dog in hierdie stadium wil ek ons opregte dank aan hulle betuig vir hulle ondersteuning in die verlede en hulle ook die beste toewens in hulle nuwe werkkringe.

STREEKSTAKKE :

Gedurende die jaar onder bespreking het die Streekstakke in Oos Kaapland en Natal steeds bevredigend funksioneer.

HALFJAARLIKSE UITVOERENDE VERGADERING :

Germiston het as gasheer opgetree vir die halfjaarlikse Uitvoerende Vergadering in 1961. Namens alle betrokke persone wil ons Sy Edele die Burgermeester en Raadslede van daardie stad vir hulle gasvryheid by daardie geleentheid bedank.

ONDERKOMITEES EN VERTEENWOORDIGERS :

Weereens wil ons met genoeë die Vereniging se waardering uitspreek teenoor die verskillende Onderkomitees sowel as verteenwoordigers na ander tegniese komitees en organisasies vir hulle waardevolle werk ten behoewe van lidmaat ondernemings gedurende die jaar onder bespreking.

Aan u, Mnr. Voorsitter en al die lede van die Uitvoerende Raad my innige dank vir die bystand en hoflikheid aan ons gedurende die afgelope jaar betoon.

Aan die Vereniging en al sy lede ons beste wense vir 1962/63.

R. G. EWING,
Namens Davidson & Ewing (Edms.) Bpk.,
Sekretarisse.

15 Maart 1962.

Association of Municipal Electricity Undertakings of Southern Africa

BALANCE SHEET — 28th February, 1962.

1961		£		R	
R8,920	ACCUMULATED FUNDS		4,688		9,377
9,490	Balance at 28th February, 1961	4,460		8,920	
570	**Add:** Excess of Income over Expenditure for the year	228		457	
	PROVISIONS		166		331
180	Agents Commission	84		167	
178	Sales Commission	82		164	
—	SUNDRY CREDITORS		58		117
992	SUBSCRIPTIONS IN ADVANCE		—		—
3,702	DEPOSITS ON LIVINGSTONE CONVENTION TRAVELLING EXPENSES		—		—
500	GRANT RECEIVED IN ADVANCE FOR LIVINGSTONE CONVENTION EXPENSES		—		—
R14,472			£4,912		R9,825

1961		£		R	
R2	PRESIDENTIAL BADGE Nominal Value		1		2
99	FURNITURE AND FITTINGS— at cost less depreciation		45		89
8,309	INVESTMENTS		3,569		7,138
2,000	200 6% Permanent Paid Up Class "B" Shares of R10 each, fully paid	1,000		2,000	
3,994	Fixed Deposit	2,106		4,212	
2,315	Savings Account	463		926	
2,099	DEBTORS		1,172		2,345
182	PAYMENTS IN ADVANCE		70		140
20	DEPOSIT Davidson & Ewing (Proprietary) Limited		10		20
3,761	CASH AT BANK		45		91
R14,472			£4,912		R9,825

Davidson and Ewing (Proprietary) Limited
per R. G. EWING
Secretaries.

C. LOMBARD, President.

Report of the Auditors to the Members of the Association of Municipal Electricity Undertakings of Southern Africa.

We report that we have examined the books, accounts and vouchers of the Association for the year ended 28th February, 1962; we have satisfied ourselves of the existence of the securities and have received all the information and explanations we required. In our opinion the above Balance Sheet is properly drawn up so as to exhibit a true and fair view of the state of the affairs of the Association as at 28th February, 1962, according to the best of our information and the explanations given to us and as shown by the books of the Association.

SAVORY, BRINK, CREMER & CO.,
Chartered Accountants (S.A.), Auditors.

Johannesburg, 15th March, 1962.

Association of Municipal Electricity Undertakings of Southern Africa

INCOME and EXPENDITURE ACCOUNT for the year ended 28th February, 1962.

1961		£	R
38	Audit Fee	35	70
—	Bad Debts—Advertising in Proceedings	80	160
28	Bank Charges	18	37
3,882	Convention Expenses	1,316	2,632
11	Depreciation—Furniture and Fittings	5	10
726	Executive Council Expenses	222	443
18	Insurance	5	10
138	Postages and Telegrams (General)	66	132
350	Printing and Stationery (General)	161	322
1,800	Secretarial Fees	900	1,800
30	Subscriptions	15	30
25	Sundry Expenses	110	219
87	Telephone	52	105
570	Exxcess of Income over Expenditure transferred to Accumulated Funds	228	457
R6,563		£3,213	R6,427

1961		£	R
380	Income from Investments	206	412
78	Profit on Sale of Proceedings	84	169
2,769	Subscriptions and Attendance Fees—Affiliates	1,139	2,278
3,492	Subscriptions—Council and Other	1,779	3,559
—	Sundry Revenue	5	9
R6,563		£3,213	R6,427

ASSOCIATION OF MUNICIPAL ELECTRICITY UNDERTAKINGS OF SOUTHERN AFRICA

Schedule 1

PROCEEDINGS			
Advertising (gross)		1,683.00	
Sales		438.00	2,121.00
Less:			
Cost of Printing		1,690.91	
Provision for Sales Commission	164.30		
Less: Overprovided 1961	16.00	148.30	
Provision for Agents Commission	167.00		
Less: Overprovided 1961	54.39	112.61	1,951.82
Net Profit on sale of Proceedings			R169.18

S.A. BUREAU OF STANDARDS AND RECOMMENDATIONS COMMITTEE REPORT

Mr. President and Gentlemen,

I have pleasure in presenting the report on the activities of the South African Bureau of Standards during the past year.

ELECTRIC ARC WELDING SETS

The Standards Council approved this project on February 12, 1962, and a committee has been appointed.

ISOLATING TRANSFORMERS

The first and second meetings of the committee were held on November 17 and December 12, 1961, respectively.

DISTRIBUTION TRANSFORMERS

Sub-committee meetings were held on April 26 and October 5, 1961, to draw up tables of standard dimensions, ratings and losses. A questionnaire regarding dimensions was circularized to the members of the committee, and a summary of their replies has been prepared. The second draft for the main committee is now in preparation.

SABS 98, PAPER INSULATED ELECTRIC CABLES FOR HEAVY DUTY

This specification has been re-written in order to fall in line with the revised SABS 97. Roneoed copies are now available.

SABS 156, MOULDED-CASE CIRCUIT-BREAKERS

The final meeting of the committee was held on November 26, 1961, and the specification is now in the editorial stage.

SABS 167-1953 (REVISION), APPARATUS CONNECTORS FOR PORTABLE DOMESTIC APPLIANCES

The first meeting of the committee was held on February 16, 1961.

SABS 168 (REVISION), MEDIUM VOLTTAGE VULCANIZED RUBBER INSULATED CABLES AND FLEXIBLE CORDS FOR POWER AND LIGHTING PURPOSES

The first committee meeting was held on March 23, 1961. At this meeting it was decided that further work on the specification would be postponed until more information in connection with aging tests and the use of synthetic rubber in cable insulation is available. It was also decided that a separate specification for welding cables, covering dimensions and electrical properties, should be drawn up.

SABS 177, PORCELAIN AND TOUGHENED GLASS INSULATORS FOR OVERHEAD POWER LINES

The final meeting of the committee was held on November 7, 1961. Some overseas comments were received after this date. These were circularized to committee members on January 8, 1962.

SABS 187, HIGH AND LOW VOLTAGE BUSHINGS

The final draft of this specification is now being prepared. The Standards Council has approved the preparation of a separate specification for standard bushing insulators, which will give a range of standard sizes for both the insulating and the conducting components of the bushings.

SABS 03-1952, CODE OF PRACTICE FOR THE PROTECTION OF BUILDINGS AGAINST LIGHTNING

The first draft of the revision of this code of practice is being prepared.

CODE OF PRACTICE FOR THE LIGHTING OF STREETS AND HIGHWAYS

The second meeting of the committee was held on June 8, 1961.

SAFTY SPECIFICATIONS

In the Government Gazette of December 15, 1961, under Government Notice No. 457 of 1961, it was proposed to declare the undermentioned specifications to be compulsory specifications. Interested persons were given a period of two months in which to lodge objections against the proposed declaration.

SV 124-1960 Manually operated airbreak switches.
SV 125-1960 Portable electric immersion heaters.
SV 126-1960 Electric air heaters and radiators.
SV 127-1960 Flexible cords for power and lighting purposes.
SV 128-1960 Portable electrical appliances for heating liquids.
SV 129-1960 Plugs, socket outlets, and socket outlet adaptors.
SV 130-1960 Electric hand lamps.
SV 131-1960 Electric stoves and hotplates.
SV 132-1960 Lampholders and bayonetcap lampholder adaptors.
SV 133-1960 Apparatus connectors for portable domestic appliances.

The Bureau received an objection to SV 124-1960 for manually operated airbreak switches and also SV 129-1960 for plugs, socket outlets and socket outlet adaptors.

In regard to the promulgation of the safety specifications, the AMEU and many Engineer members have received a copy of the document indicating that it was the intention of a certain firm to lodge an objection to the promulgation of the safety specifications No. SV 129-1960 and SV 124-1960. It appears that the objector feels that the specifications should be more restrictive. The safety specifications are the minimum requirements for safety and are not intended to be specifications for quality articles. Your Association has informed the objector that it could not support the objection.

It will be remembered that the AMEU has been pressing for the promulgation of these safety specifications for about ten years, which it is hoped will assist in providing a measure of safety to the benefit of the whole community in Southern Africa.

In conclusion I should like to thank the Bureau officials for their kind assistance during the years, and a big thank-you to the members of the AMEU who have assisted me in keeping up with the activities of the S.A.B.S. technical committees in representing the AMEU on these various cvommittees.

J. C. DOWNEY,
A.M.E.U. Representative to the S.A.B.S.
Technical Committees.

WIRING REGULATION COMMITTEE

As there were no meetings of the above committee held during the year, I have nothing to report.

J. C. DOWNEY,
A.M.E.U. Representative to Wiring
Regulation Committee.

REPORT ON THE RECOMMENDATIONS COMMITTEE FOR NEW ELECTRICAL PRODUCTS

I have to report that

During the past year the chairman, Mr. J. L. van der Walt resigned from engineering to take up a clerical post. As the other representative of the A.M.E.U. it has fallen upon me to take the place of the Chairman. In order to fill the vacancy created by the resignation of Mr. Van der Walt, Mr. C. Lombard kindly consented to serve on this committee.

Two meetings of this committee were held during the year and the recommendations have been submitted to the members through the news bulletins.

Applications still continue to be received although in some cases the applications are not considered as there exists a relative S.A.B.S. or B.S. 1 specification for the product.

The committee in its terms of reference can only consider a commodity for which there is no relative S.A.B.S. or B.S. 1 specification.

It has been noted that on occasions some large centres have given permission for use of certain commodities which are subsequently submitted for consideration by the Committee. In order to avoid embarrassment, it is suggested that it would be to the advantage to all concerned if an enquiry were to be submitted to the Secretary before permission is granted.

Our thanks are due to the representatives of the Bureau of Standards, the Electricity Supply Commission, the South African Institute of Electrical Engineers, the Electrical Engineer and Allied Industries Association, the Electrical Contractors Association of South Africa and the Johannesburg City Council for their kind and valuable assistance and service on this committee.

J. C. DOWNEY,
Chairman.

ELECTRICAL WIREMEN'S REGISTRATION BOARD ANNUAL REPORT 1961

The Board met on 11 occasions during the year in addition to a visit to the examination centre at Olifantsfontein.

Four written examinations were held, 467 candidates writing the examinations. The number of candidates who passed the written examination was 77 or 16.5%.

Nine practical examinations were held and 275 candidates tested. 139 or 50.5% were successful.

340 applications for registration were considered of which 323 were accepted for the examinations and 17 deferred or refused.

Since the inception of the Act 7,842 certificates have been issued, 5,416 of these by examination.

No new areas were determined during 1961, but 12 applications have been received and are being investigated.

Certain amendments to the Act, mainly in line with those proposals submitted by the Association some years ago, will probably be included in the legislation programme for 1962.

During the year Mr. G. J. Malan was transferred to another Department and Mr. J. J. Groenewald was appointed Chairman of the Board.

R. W. KANE,
Representative.

PRINTED BY JOHN O. RODD (PTY.) LTD.