Engineering Skills
Key to effective service delivery

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Chinese curse: May you live in interesting times

“Like it or not we live in interesting times. They are times of danger and uncertainty; but they are also more open to the creative energy of men than any other time in history.”

Cape Town, 1966
COLLECTIVE CRISES

- Generation and transmission crisis ("bulk power problem")
- Distribution crisis
- Skills and resources crisis
- Credibility and communications crisis
- Require holistic solution
ENGINEERING SKILLS

• Chronic skills shortage in engineering sector = Multi-faceted problem
  – Historical education legacy in SA = skills developed disproportionately in population
  – Global skills demand and resultant global skills mobility
  – Deficiencies in present school system particularly around maths and science
  – Collapse of traditional artisan training
  – Inadequate contribution through SETAs

• Resource and skills problems reflected across industrial, engineering and infrastructural sectors

• Electricity crisis across the supply chain underpinned by a skilled resource crisis

• Confronts us with a huge international challenge and global competition for finite resources
- Sasol – “moderate delays and increased costs” due to global shortage of engineering and construction resources (March 2007)

- Sasol study: 184 projects – value R62 billion – projects likely to take average of 11% longer

- Recent (2007) international benchmark study on project costs
ELECTRICITY INDUSTRY

• Similar challenges.

• Ongoing EDI restructuring hiatus and other factors exacerbate problem.

• Problems/challenges manifest in
  – Underinvestment in skills
  – Loss of morale
  – Exodus of skilled and experienced staff
  – Inexperienced personnel ill-equipped for roles and responsibility (“set-up to fail”)
  – Inadequate mentoring and training
  – Inability to attract staff with appropriate skills and experience

• Resultant Negative effects
  – Design, Maintenance and Planning
  – Engineering management
  – Morale and career and competence development

• Crisis situation across industry, particularly but not only at smaller municipal utilities

• “Skilled resources seek opportunity not need”
## SAICE REPORT CARD
### ELECTRICITY DISTRIBUTION

<table>
<thead>
<tr>
<th>Description</th>
<th>Grade</th>
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</thead>
<tbody>
<tr>
<td>Eskom’s generating and bulk transmission capacity</td>
<td>C+</td>
</tr>
<tr>
<td>Eskom’s local distribution networks</td>
<td>C+</td>
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<tr>
<td>Municipal distribution networks in major urban areas</td>
<td>C-</td>
</tr>
<tr>
<td>Municipal distribution networks in all other areas</td>
<td>D-</td>
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</tbody>
</table>
SAICE REPORT CARD
OVERALL INFRASTRUCTURE GRADING

D+

Water, Sanitation, Solid waste management, Roads, Airports, Ports, Rail, Electricity distribution, Hospitals and clinics

Communications, ICT, industrial ??
ELECTRICAL SECTOR

• NERSA audit of 11 utilities
  – Eskom distributors well staffed and resourced
  – Large municipal undertakings “faltering”
  – Smaller undertakings significantly under-resourced.
  – Skill issues core to problems being experienced

• Further studies of utilities (much larger sample – 10x)
  – Only approx 1/3 had sufficient competent staff
  – Only 15% of networks found to be in an acceptable condition
  – Adequate maintenance plans in 43%
  – Acceptable technical asset registers in 23%

• Operational and maintenance conditions, and key support planning issues, significantly influenced and impacted by insufficient competent staffing levels

• EDI restructuring hiatus impact

• Eskom situation
  – ECSA presentation: positive trends technicians/technologists with significant challenges seen at engineer and artisan level
  – Ratio of artisans in engineering team: artisanal training must be major issue of concern
  – Eskom tackling training decisively – launch of Eskom Academy. Focus on on-the-job skills training at all levels in the engineering team
• W/Europe, N/America, India and China have between 130 – 450 people per engineer. In RSA 3200 people per engineer

• Taiwan: ½ the population of RSA, 10x num graduate engineers

• China: 30-46% of all graduates in engineering (≈ 500000 per annum)
ECSA FIGURES: 1998 - 2004

UNIVERSITIES OF TECHNOLOGY

Enrolled
Graduate
Elec enrol
Elec grad

1998 1999 2000 2001 2002 2003 2004
significant challenges

• Exacerbated by crisis in engineering education
• Staff vacancies at astonishingly high levels
• Academic salaries eroded significantly
• Filling current posts let alone additional posts very difficult

JIPSA target
Increase level of graduate engineers from current 1400/annum to 2400/annum over next ~4 years
COLLAPSE OF ARTISANAL TRAINING

Reported 8000 artisans being produced per year through Indlela & SETAs. JIPSA reports target of 12500/annum over next 4 years. Indications that this should be much higher.

COTT/Indlela figures:
Throughput fairly constant at ave 3079 passes/annum over past 4 years to 3/08. Pass rate dropped each year from 49% in 2004/5 to 37% in 2007/8.
JIPSA report March 07 refers to a target of 50,000 engineers/tech and artisans by 2010.
INCREASING OUTPUT

- Impact over medium to longer term
- Need to increase number of “qualifying students”
- Availability of suitable lecturers and tutors
- Professional registration not the major bottleneck in engineering skills “pipeline”, contrary to assertions around proposed BE Professions Bill
- Encouraging realisation by industry to establish retention and training programmes
- Encouraging apparent realisation by government of urgency and apparent inability of existing structures to deliver the skills base (esp at artisan level)
- Clear from industry reports and comments that a review of the SETA philosophy, approach and structures required to address problems in a sustainable and effective manner.
CHALLENGES & CONSTRAINTS

• In 2007 Matric results
  – Maths HG passes up 0.8%, Science HG passes down 5.6%
  – Maths HG 25415, Science HG 28122
  – Maths HG C-aggregate approx 8000

• School grades no longer considered a reliable measure of preparedness for university study

• School performance becoming less and less accurate as means of measuring likely performance at university

• Other dominant factors in success
  – Level of commitment given demanding programme
  – More critical – whether student can afford costs of studying
CHALLENGES & CONSTRAINTS

• Need to increase number of “qualifying students”
  – Grades
  – Aptitude
  – Preparation (including thinking skills, literacy skills)
  – Interest and commitment

• Questions around.......
  – Changes in school system re discontinuing of HG and Additional Mathematics
  – Numbers studying Mathematics in new NSC
  – Availability of skilled teachers
  – Maths 3rd paper optional = geometry optional

• Consider/debate approach to matric or NSC
  – Overemphasis on “academic matric”? 
  – Social acceptance and “social status” of vocational training
  – See as viable, valuable and respected/respectable education and career option
TIMELINES

- GRD 10-12: 3 YRS
- UNIV 1-4 (5): 4 - 5 YRS
- TRAIN 1-3: 3 YRS

Years:
- 2008
- 2011
- 2015/6
- 2018/9
CHALLENGES & CONSTRAINTS

• Global Market – technically skilled people are globally mobile

• Retention of existing skills critical (micro & macro level)

• Sell and maximise the pull factors, minimise the push factors, create the opportunities

• Need to be cautious about the signals sent, the perceptions (and reality) created and policies adopted

• Supply and demand economics
• Importing skills is an option

• CDE report

• 3 key realities in South Africa
  – Global market for skills
  – Historical legacy of disproportionate skills development
  – Unsustainable economic growth without skills injection

• Benefits of skilled immigrants (apart from the obvious)
  – Productive immigrants tend to pay tax
  – Tend to save
  – Tend to be entrepreneurial

• Same benefits also make South African skills attractive in other countries

• SA skilled immigration figures in 2006
  – 194 permits granted for people with scarce skills
  – Quota system allows for 47600
  – Subsequent reported improvement
CHALLENGES & CONSTRAINTS

• Other challenges re skills imports
  – Macro factors (security etc)
  – Career opportunities and development
  – Employment practices and policies
  – Relative remuneration
  – Cultural idiosyncrasies and language issues

• Already experienced problems wrt relative standards and skills/qualifications levels and registration and licensing
  – Important iro direct and indirect safety issues (engineering personnel and public) and general socio-economic interest of the public
  – International benchmarking in SA through ECSA
  – Not “gatekeeping”
  – Match training/expertise to appointment
  – Verification of foreign qualifications and experience can be challenge
  – *Need to ensure process optimisation without compromising standards*

• Resource constraints often lead to early advancement to positions of management and/or technical responsibility
  – Mentoring and training constraints
  – Cannot be setup to fail
CHALLENGES & CONSTRAINTS

• Industry transformation & skills growth among PDI sector critical in addressing skills shortages

• Registration statistics encouraging in environment where registration still effectively voluntary
  – ECSA: 56% registrations in last 3 yrs PDI
  – ECSA: 61% electrical PrEng last 3,5yrs PDI

• Historical legacy implies that transformation growth must come from younger generation – encouraging trend in education output and entrants to industry
LOOKING AHEAD

- Need industry wide holistic strategy on skills retention, usage, development and employment

- Common vision within a global scenario

- Organic skills growth takes time – no time to waste now, from schooling system through tertiary education and on-the-job training and mentoring

- JIPSA approach has 3 clear strategies
  - Increase tertiary output
  - Import appropriate skills
  - Retain *(and develop)* existing skills

- “Get them young” – nurture interest and affinity science and technology
  - Implications for educators and professional and industry associations
  - Direct and Indirect approach including Role Models

Increasing tertiary output
medium to longer term
SHORT to MEDIUM TERM

- Global market scenario to attract and retain skills within the industry and the country
  - Sell the pull factors, minimise the push factors & offer opportunity
  - Perceptions are reality
  - Micro and macro issues
  - Organisational structure issues

- Apply AA/EE in a nuanced manner

- Outsourcing in short term
  - Risks and challenges to infrastructure/network/utility operator in medium/longer term
    - Authority and responsibility frameworks
    - Retention of information and institutional knowledge
    - Co-ordination & retention of activities
  - Inherent underlying shortages necessitating outsourcing exacerbates these
  - Need core expertise to manage
  - Does not empower operator/owner

- Displaced & early retired skills ("grey power")
  - Nurture and mentor
  - Transfer knowledge
  - Viable and attractive option
  - Also need to address authority and responsibility frameworks

- Reconsider the Built Environment Professions Bill
MENTORSHIP & TRAINING

• Effective mentorship and training must be a key deliverable in any interventions

• Must be a priority focus throughout industry

• All facets/levels in engineering team

• Training opportunities for students & young entrants

• Constraints in industry
  – Available resources
  – Availability of resources

• Mobilise resources of industry and professional bodies for sustainable solutions
BURSARIES

• Availability of funding important success factor

• Problems:
  – Effectiveness of schemes
    • Case study of 57 engineering team bursaries over 3 years
    • Anticipated throughput of 42% (if take up positions)
    • Ability to induct and mentor new resources?
  – Take up bursary without real interest or commitment
due to good availability of engineering bursaries
  – SAIEE noted trends:
    • Declining applications
    • Declining academic quality of applications

• Need intensive study of bursary environment,
  key success factors and negative influences
FURTHER CHALLENGES

• Career choice drivers – making engineering a desirable option

• Address issues around learnerships
  – Entry standards and aptitude testing
  – Appropriate and effective measurement standards
  – More “customised” training (SETA product vs inhouse)

• Relook at apprenticeship training schemes

• Reassessment of current approach and SETA structures urgently required

• Complex issue, with creative thought and debate required with a common vision and purpose (business, education & training, government) – develop coherent strategy to tackle skills crisis

• Staffing and infrastructural inadequacies at tertiary institutions critical
IN CLOSING

• **FAILURE IS NOT AN OPTION** in addressing our skills crisis in the engineering (including electrical) sector

• Organic skills growth will take time = need to start addressing the fundamental issues urgently with serious and realistic intent

• Holistic solution is key requirement
  – School level (start of pipeline) particularly maths & science
  – Academic vs vocational schooling/education
  – Career choice drivers – make engineering attractive & create opportunities
  – Facilitating tertiary output
    • Financing and affordability
    • Support systems
    • Student training opportunities
    • Academic/training staff challenges
    • Artisanal training structures and throughput
  – Deliver effective Mentoring and Training opportunities
  – Short term options
    • Outsourcing
    • Imported skills
  – “Grey” power (outsourcing and mentoring/training)
  – Organisational structure issues (attraction/retention of skills)
  – Retain existing skills in global market scenario

• Resolution of EDI restructuring hiatus