Maximising the potential of Energy Efficiency and Demand Side Management in South Africa

By Vashna Singh, Eskom, Demand Side Management

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# Presentation Objectives

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Global context for Energy Efficiency and Demand Side Management
Energy Efficiency and Demand Side Management (EEDSM) is a compelling response option addressing the macro challenges facing the global energy industry.

Global Concerns

- Globally countries are increasingly concerned about:
  - Rapid growth in the demand for energy
  - Energy security of supply
  - Diminishing and unstable supplies of conventional energy sources,
  - Cost of energy generation
  - Increasing fossil-fuel related air pollution
  - Climate change

EEDSM as a Response

- EEDSM options are international best practices for the following reasons:
  - Lower economic cost as compared to supply side options
  - Is quickly executable and scalable
  - Can act as an accelerator for economic growth through process efficiencies and job creation.
  - Reduces air pollution - is a climate change mitigation option, resulting in less damage to human health and the environment

The South African electricity challenge is not unique. World Energy Council reports that nearly 70 countries around the world, for varying reasons have energy efficiency policies addressing a range of macro challenges.
Overview of Demand Side Management Options
The Energy Conservation Scheme and Energy Efficiency Demand Side Management are core to the national electricity recovery effort

**Overarching Recovery Mandate**

**Ensuring Security of Supply**

**Primary Recovery Options Available**

**Supply-Side Options**

- Power Conservation (PCP)
- Pricing
- Power Buy Back
- Load Shedding
- Load Reduction
- Demand Side Management
- Public Awareness

**Demand-Side Options**

**Electricity Growth Management**

- Growth management framework and approach on how new connections and additional consumption should be managed
- Prerequisite for this, is that savings will be captured through ECS

**Energy Conservation Scheme (ECS)**

- National scheme to achieve overall 10% energy reduction through a formalised demand management programme
- Mandatory for targeted participants (regulation required)
- Enable accelerated uptake of DSM and co-generation
- Estimated period for programme is 4-6 years, until acceptable energy balance restored

**Energy Efficiency Demand Side Management (EEDSM)**

- Focus on rolling out energy efficiency and load reduction technologies which are able to reduce the national demand profile on a sustainable basis
- EEDSM technologies “hardwire” the savings, including the customer behaviour brought about by the PCP.

**Hardwiring**

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National Achievements to Date
DSM has proven it’s ability to contribute savings to the national grid and has consistently exceeded NERSA defined targets.

Although past the performance of DSM initiatives has been sound, the current electricity situation necessitates that further savings be sought through refined EEDSM strategy.
The Updated DSM Strategy
Changes in internal and external drivers have necessitated a refinement of the existing strategy

<table>
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<tr>
<th>Previous DSM strategy</th>
<th>Refined DSM strategy</th>
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<tr>
<td>1. Capacity shortage focused – load shifting projects (mismatch to current NERSA’s EEDSM Policy framework)</td>
<td>1. Energy and capacity shortage – increased focus on energy efficiency rather than load mgt</td>
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<tr>
<td>2. Large, scale residential acceleration</td>
<td>2. Acceleration of large, scale residential key programs and industrial and commercial sector key programs (as per System Operator’s Merit order)</td>
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<td>3. Historic EEDSM policy framework – projects driven by regulatory limit of R3.5m/MW</td>
<td>3. Anticipated changes to EEDSM – projects driven by avoided costs and need for DSM to “hard-wire” savings in a sustainable manner</td>
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<td>4. Long-term hardwiring of 26TWh savings</td>
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<td></td>
<td>5. Given longer-term cost drivers for electricity and new build the economics DSM options become more attractive</td>
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The primary reason for the shift in focus from load management to energy efficiency technologies is that energy efficiency technologies provide more permanent long-term energy reduction whereas load management is focused on smoothing the load profile.
The principles supporting the refined DSM strategy are more output and measurement-focused...

Measurable and sustainable savings that add value to the country, national system, distributors and customers

Focus on Energy Efficiency rather than Load Management, as per System Operator’s Merit Order:
• First priority is for high load factor energy efficiency savings (industrial and commercial sector)
• Second priority is for other sector energy efficiency savings (residential sector)
• Centrally controlled Eskom load management would be preferable in future as this is the most optimal way in ensuring load management benefits to the national grid are realised.
• Previous load management that can not be centrally controlled should be treated as contingency measures

Promotion of Innovation in DSM – ensuring reliable and sustainable technology management supported by:
• Research,
• Standards and specifications,
• Established supply chain,
• Installation capacity,
• Organisational capacity, and
• Customer and industry education

Improvement in overall EEDSM output and turnaround times (more GWh and MW sooner)
What is the Potential for EEDSM in South Africa?
The residential, industrial and manufacturing sectors account for the largest share of electricity demand and consumption in South Africa.

### Energy vs. Demand per Sector

<table>
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<tr>
<th>Sector</th>
<th>High Potential for DSM Savings</th>
<th>Immediate focus on Commercial Sector is vital to meet the FIFA 2010 Soccer World Cup objectives</th>
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<tbody>
<tr>
<td>Residential</td>
<td>35.1</td>
<td></td>
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<tr>
<td>Agriculture</td>
<td>3.6</td>
<td></td>
</tr>
<tr>
<td>Mining</td>
<td>11.6</td>
<td></td>
</tr>
<tr>
<td>Industrial &amp; Manufacturing</td>
<td>35.4</td>
<td></td>
</tr>
<tr>
<td>Commercial</td>
<td>12.6</td>
<td></td>
</tr>
<tr>
<td>Transport</td>
<td>1.8</td>
<td></td>
</tr>
<tr>
<td>General</td>
<td>12.3</td>
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Source: Energy data 2006/7 from NERSA, demand data from DSM Department & ISEP

Notes
- The residential sector offers the greatest potential for EEDSM savings as there is a significant variance between Energy Demand and Energy Consumption.
- Additionally, the residential will offer the best opportunities to quickly roll-out low-cost / high-impact technologies (e.g. CFLs).
- The industrial and commercial sectors offer significant opportunities for EEDSM, however, these opportunities will initially come at a higher cost per MWh due to the technologies involved (e.g. motor efficiency).
The market potential for EEDSM in South Africa is estimated to be 7407 MW (medium load factor) over the next 5 years.
Program Design: Cost-effective & sustainable technology mix
The most cost effective technologies are Energy Efficient Lighting (CFLs), Aerated Showerheads and Smart Metering.

Household Cooking conversion to gas is primarily constrained by the cost and availability of gas.

Solar Water Heating (SWH) is constrained by supplier capacity and higher costs.

Notes
Analysis of the relative costs per MW, time to roll-out and sustainability of the DSM technologies for the Residential Sector.

Notes:
- Short-term implementation programmes (Area 2) include CFLs, Street Lights and Geyser Blankets & Gas Cooking.
- Medium to Long-term implementation projects include SWH, Smart Metering, Aerated Showerheads.

Key:
- R/MW Cost
- Priority Areas

Note:
Bubble size indicates R/MW – the larger the bubble the more expensive the cost per project.
Commercial Sector cost and benefit analysis (current 3-Year Plan)...

All technologies within the Commercial Sector are cost efficient.

Notes

Note: Scale not standardised relative to other sectors
Source: DSM Impact Model; Team Analysis
Analysis of the relative costs per MW, time to roll-out and sustainability of the DSM technologies for the Commercial Sector

Motor Efficiency savings have high sustainability and can be quickly implemented. Efficient Lighting and HVAC can be quickly implemented (Sector 2) but offer less in the way of sustainable savings.

Notes

Bubble size indicates R/MW – the larger the bubble the more expensive the cost per project.
The Total Avoided Costs and the Project Costs per kWh for the Industrial Sector initiatives are nearly identical.

Motor Efficiency initiatives however provide most MW savings and should therefore be the primary focus area of the sector.

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- Motor Efficiency initiatives however provide most MW savings and should therefore be the primary focus area of the sector.

Key:
- Bubble Size: GWh Savings
- Incentivised Programmes
- Priority Areas

Note: Scale not standardised relative to other sectors
Source: DSM Impact Model; Team Analysis
Analysis of the relative costs per MW, time to roll-out and sustainability of the DSM technologies for the Industrial Sector

- Motor Efficiency initiatives can be rapidly implemented and offer the most sustainable MW savings.
- All other technologies can be implemented within a shorter 2-year horizon but offer less sustainability in terms of MW savings.

Notes

Key:
- R/MW Cost
- Priority Areas
Specific technologies have been identified for the three key sectoral focus areas of the DSM roll-out programme

<table>
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<th>Sector Focus</th>
<th>Project Types</th>
<th>Technology Focus</th>
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<tr>
<td>Residential</td>
<td>Primarily mass roll out projects</td>
<td>1. Efficient lighting, 2. Solar water heating, 3. Smart meters</td>
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Source: Eskom DSM Department; Team Analysis

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The current 5 year EEDSM plan projects a 2600 – 3500 MW saving which is below the potential – specific enablers need to be addressed.

What are the key success factors for unlocking the country’s EEDSM potential?

7407 MW of EEDSM Potential
A synergised, holistic and co-ordinated national strategy, encompassing the key success factors to maximise the potential of all demand management potential is required.

Demand Management
- Target Setting
- Progress Tracking
- Measurement & Verification

Integrated National Planning

Defined Funding Mechanisms

Effective Program Design & Delivery

National Policy & Legislation

Regulation

Intensified National Awareness
(Customer Education)

Relationship building
(Collaboration, strategic partnerships)

National
Provincial
Municipal
Customer

EEDSM

Maximising the Potential of EEDSM & Hardwiring ECS Savings
Recommendations on key success factors for maximising EEDSM potential in South Africa

**Policy**
- Align with country’s objectives
- Set out the energy landscape for the country
- Clarify national roles and responsibilities
- Fiscal policy – tax incentive for energy efficient technologies
- Wavering of import tariff on key energy efficient appliances

**Legislation**
- Electricity Regulation Act acknowledges that all licensees to make provisions for EEDSM
- Regulations at the point of sale and at the point of installation, by-laws for energy efficiency gains
- Energy Efficient Appliance Labelling - restriction on sale of energy inefficient appliance
- Compulsory energy efficient building standards (SANS 204 series)

**Funding**
- Sustainable, reliable source of funding
- Funds Management
- Effective funding disbursement

**Regulations**
- Up to 100% funding on all projects, based on the minimum of actual programme cost or net present value of avoided generation cost
- Include energy efficient new building – “Greenfields”
- Allow for implementation by customer, including the Standard Offer approach
Recommendations on key success factors for maximising EEDSM potential in South Africa continued…

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<th>National Integrated Planning</th>
<th>Program Design &amp; Delivery</th>
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<td>▪ Consolidate and integrate the plans of distributors, industrial and commercial customers</td>
<td>▪ Cost-effective, sustainable, measurable, value-adding programs that are replicable</td>
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<td>▪ Apply national strategic parameters, enablers and constraints</td>
<td>▪ Capability building, knowledge transfer &amp; installation training</td>
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<tr>
<td>▪ Avoided double counting of initiatives</td>
<td>▪ Promotion of Innovation in DSM by undertaking research, applying compulsory standards and specifications,</td>
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<tr>
<td>▪ Facilitates target setting, progress tracking, reporting and measurement &amp; verification</td>
<td>▪ Enable market transformation by establishing reliable supply chain</td>
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<td>▪ Enhance organisational capacity to deliver</td>
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<tr>
<th>Relationship Building</th>
<th>National Awareness</th>
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<td>▪ Principle of collaboration across all levels</td>
<td>▪ Continuous awareness entrenching internalised energy efficient consciousness and behaviour</td>
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<td>▪ Active engagement of all stakeholders in the value chain including end use customers</td>
<td>▪ Strong publicity campaigns on how to save, which technologies and how to access programs</td>
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<td>▪ Strategic partnering</td>
<td>▪ Aggressive industry and customer education through multiple delivery channels</td>
</tr>
<tr>
<td>▪ Develop and maintain strong supplier relationships</td>
<td>▪ School’s program as part of standard curriculum</td>
</tr>
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<td>▪ Sharing of best practices, avoid duplication of efforts</td>
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Tapping into additional potential
Tapping into addition potential over the coming years

- Current DSM Mix
  - Existing, proven technologies
  - Focus on low-cost / high-impact technologies

- The Immediate Future
  - New technologies and technologies not yet used in Southern Africa

- The Near Future
  - Technologies in concept development stage

- The Far Future
  - Technologies yet to be discovered

DSM Potential

Time

1-5 Years

- Smart Metering
- Efficient Lighting
- Solar Water Heaters
- HVAC
- Alternative Energy

5-10 Years

- Solar Farms
- Wind Farms
- Other Sector Technologies

10 Years +

- Geo-thermal energy
- Wave Energy

ILLUSTRATIVE
The EEDSM benefits alignment with South Africa’s objectives
EEDSM contribution to South Africa’s objectives

South African EEDSM benefits

- Improve energy security (balancing supply & demand)
- Mitigate power shortages and reduce load shedding
- Provide a long-term hedge against future power crunches
- Avoided generation cost savings – long-term decrease in the electricity price increase, retain economic competitiveness
- Improve energy intensity of electricity users
- Creation of space in the energy system for growth
- Job creation (approximately 16 000 temporary jobs created by the CFL mass roll implementation)
- Savings of natural resources (water & coal)
- Reduce the emissions of harmful gases (SO2, NOx, CO2)
- Improved business efficiency (smart meters)
- Market transformation long-term benefit, including local manufacturing
- Potential to reduce or defer spending on power sector capacity expansion in the long-term
Conclusion

In the last 9 months, remarkable achievements that shape the future have been made:

- Electricity regulations on standards, norms and prohibitions (6 months)
- NRS 049 – Specifications for smart metering (6 months)
- Energy Bill
- Proposed DME Electricity Pricing Policy

The first step in maximising the potential of Energy Efficiency and Demand Side Management in South Africa has been taken…

…it is time to embrace this win/win, strategic option and make this the heart of our daily business!