An overview of energy efficiency and demand side management in South Africa

30 January 2012

Tom Skinner
Overview of presentation

• Eskom and the South African Environment
• The State of the System as Driver for EE
• Energy Sectors and Activities
• Capabilities, Successes and Funding
• EEDSM Funding Mechanisms and Programmes
• Lessons Learned
• Future Focus Areas
INTRODUCTION

Eskom and the South African Environment
Eskom is the National, vertically integrated, electricity utility of South Africa

Eskom generates approximately 95% of the electricity used in South Africa and approximately 45% of the electricity used in Africa.

Eskom generates, transmits and distributes electricity to industrial, mining, commercial, agricultural and residential customers and redistributors.

Eskom is one of the top 20 utilities in the world by generation capacity.
It’s power network has an extensive footprint
which is currently being expanded to support the country’s growing supply requirements

<table>
<thead>
<tr>
<th>2011</th>
<th>Maximum self-generated capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>41 194 MW</strong></td>
<td></td>
</tr>
<tr>
<td><strong>237 430 GWh</strong></td>
<td>Total production</td>
</tr>
<tr>
<td><strong>4.7 m</strong></td>
<td>Customers</td>
</tr>
</tbody>
</table>

Build Programme

| 16 304 MW                          | Additional capacity by 2017      |
| 80 000 MW                          | Total capacity by 2026           |

Source: Eskom’s Integrated Report 2011
In support of national policy direction, Eskom administers a large scale EEDSM programme

Department of Energy

National Energy Regulator of South Africa

NEEA
National Energy Efficiency Agency

Eskom
THE STATE OF THE SYSTEM

As a Driver for EE and DSM in the Country
The system reserve margin has recovered somewhat from its lowest point in 2007, but
...and will remain tight into the foreseeable future (as at August 2011)

If only the base case assumptions materialise, the shortfall in supply continues until 2015. These include the current Eskom build plan, DoEIPP REFIT as per IRP1, DSM, Generation planned maintenance of ~10%.

Energy gap closes as build programmes complete and IDM programmes take effect.
The state of the electricity system is a driver for energy efficiency (as reflected in the IRP)
INDUSTRIES

Energy Sectors and Activities
Electricity Consumption per Sector

Consumption
Total: 190,396 GWh

- Mining: 18%
- Industry: 49%
- Commerce: 10%
- Transport: 2%
- Agriculture: 4%
- Residential: 17%

Demand
Total: 31,928 MW

- Mining: 35%
- Industry: 35%
- Commerce: 10%
- Transport: 2%
- Agriculture: 4%
- Residential: 35%
IDM activities previously focused primarily on three areas

<table>
<thead>
<tr>
<th>Area</th>
<th><strong>164</strong></th>
<th><strong>527</strong></th>
<th><strong>1,440</strong></th>
<th><strong>30</strong></th>
<th><strong>60</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial and mining process optimisation &amp; efficiency upgrades</td>
<td>projects</td>
<td>megawatts</td>
<td>gigawatthours/annum</td>
<td>high pressure systems</td>
<td>solar water heaters (high and low pressure systems)</td>
</tr>
</tbody>
</table>
CAPABILITIES

Past EESM Successes
Actual Evening Peak MW performance against target for each Eskom financial reporting period.

*Contracted: amounts as targeted and stipulated in the DSM project contract on M&V verified projects

**2010/11 Period Verified:**
- **NERSA funded:** 344.4 MW
- **DoE funded:** 0.5 MW
- **Customer funded:** 9.0 MW
- **Eskom internal energy efficiency projects:** 3.1 MW
Available Funding and Targets

MYPD2 Allocation for EE and DSM

5.4 billion ZAR, over 3 years, to deliver 1 037 MW demand savings and 4 055 GWh energy savings.
## Summary Of IDM Projects Approved At Various Investment Committee Since 01/04/2011 (Start of MYPD2 Period)

<table>
<thead>
<tr>
<th>Committee</th>
<th>Initiatives</th>
<th>Date Approved</th>
<th>Amount Approved</th>
<th>Peak Demand Savings (MW)</th>
<th>Annualised Energy Savings (GWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FY 2011</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICAS</td>
<td>Standard Product</td>
<td>2010/12/01</td>
<td>150,000,000</td>
<td>29</td>
<td>112</td>
</tr>
<tr>
<td>ICAS</td>
<td>Standard Offer</td>
<td>2011/01/01</td>
<td>250,000,000</td>
<td>48</td>
<td>187</td>
</tr>
<tr>
<td>DxIC &amp; CIC</td>
<td>ESCo Model / Mass Rollouts</td>
<td>01/04/2010 - 31/03/2011</td>
<td>611,552,373</td>
<td>190</td>
<td>385</td>
</tr>
<tr>
<td><strong>Total FY 2011</strong></td>
<td></td>
<td></td>
<td>1,011,552,373</td>
<td>267</td>
<td>684</td>
</tr>
<tr>
<td><strong>FY 2012</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICAS</td>
<td>Performance Contracting</td>
<td>2011/04/01</td>
<td>500,000,000</td>
<td>82</td>
<td>1,420</td>
</tr>
<tr>
<td>ICAS</td>
<td>SWH - Additional budget</td>
<td>2011/06/01</td>
<td>545,000,000</td>
<td>18</td>
<td>92</td>
</tr>
<tr>
<td>DxIC</td>
<td>ESCo Model / Mass Rollouts</td>
<td>01/04/2011 - 01/08/2011</td>
<td>39,384,546</td>
<td>9</td>
<td>67</td>
</tr>
<tr>
<td>GCIMC</td>
<td>ESCo Model / Mass Rollouts</td>
<td>01/04/2011 - 27/01/2011</td>
<td>1,106,852,550</td>
<td>205</td>
<td>920</td>
</tr>
<tr>
<td>GCIMC</td>
<td>ESCO Model - fast tracking projects</td>
<td>2011/08/15</td>
<td>30,400,000</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>ICAS</td>
<td>Performance Contracting</td>
<td>01/08/2011</td>
<td>250,000,000</td>
<td>49</td>
<td>655</td>
</tr>
<tr>
<td>IFC</td>
<td>Performance Contracting - II</td>
<td>21/11/2011</td>
<td>500,000,000</td>
<td>87</td>
<td>461</td>
</tr>
<tr>
<td>ICAS</td>
<td>Low Load Factor Bulk Rollout</td>
<td>21/10/2011</td>
<td>300,000,000</td>
<td>57</td>
<td>196</td>
</tr>
<tr>
<td>ICAS</td>
<td>SWH - Rebate Programme for FY 2013</td>
<td>28/11/2011</td>
<td>356,000,000</td>
<td>14</td>
<td>71</td>
</tr>
<tr>
<td>ICAS</td>
<td>Residential Mass Rollout</td>
<td>Submitted for 07/02/2012</td>
<td>200,000,000</td>
<td>38</td>
<td>130</td>
</tr>
<tr>
<td>ICAS</td>
<td>Aggregated Standard Product</td>
<td>Submitted for 07/02/2012</td>
<td>350,000,000</td>
<td>67</td>
<td>246</td>
</tr>
<tr>
<td><strong>Total FY 2012</strong></td>
<td></td>
<td></td>
<td>4,177,637,096</td>
<td>625</td>
<td>4,258</td>
</tr>
<tr>
<td><strong>Total FY 2011 &amp; YTD FY 2012</strong></td>
<td></td>
<td></td>
<td>5,189,189,469</td>
<td>892</td>
<td>4,942</td>
</tr>
</tbody>
</table>

### R mill / MW

5.8

### Removed From plan

The projects behind this approval were moved to other approved funding options

<table>
<thead>
<tr>
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<th>Date Approved</th>
<th>Amount Approved</th>
<th>Peak Demand Savings (MW)</th>
<th>Annualised Energy Savings (GWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICAS</td>
<td>Mass Downlighter Commercial Rollout</td>
<td>Jun-11</td>
<td>471,000,000</td>
<td>55</td>
<td>429</td>
</tr>
</tbody>
</table>

### NERSA MYPD2 Approval

<table>
<thead>
<tr>
<th>Costs</th>
<th>Demand Savings (MW)</th>
<th>Energy Savings (GWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5,445 mill</td>
<td>1037</td>
<td>4055</td>
</tr>
</tbody>
</table>
Existing Funding Mechanisms and Programmes

ESCo Model
Performance Contracting
Standard Offer
Standard Product

Mass Rollouts
Downlighters
Residential Demand

Standard Rebates
Solar Water Heating & Heat Pumps
South African periods of peak consumption
priority target for energy efficiency interventions
Demand-based payments for verified savings.

Process Optimisation, Lighting, Heat Pumps, HVAC, etc.

Individual Projects with unique requirements

Size: >1MW
Market focus: Industrial

Although demand-based, payment equates to 50-70c/kWh

Issues with ESCo model:
1) Individual project approvals and long lead times
2) Not applicable to “mass market”
3) Inconsistent evaluation criteria
4) Cumbersome governance processes
5) Complex and onerous contracts
Energy Efficiency payments at a fixed rate for a fixed period (16 hours)

Lighting, LEDs, Hot Water Systems, Solar, Industrial Process Optimisation

Replace inefficient technologies with a pre-approved suite of energy efficient products

Size: 50kW-5MW (Mon-Fri 6:00-22:00)
Market focus: Industrial / Commercial

Standard rate per kWh per technology 42 – 70 c/kWh (Peak Hours)

Sustainability ensured by procuring energy savings over a 3 year period (70% on completion and 10% pa thereafter)
Performance Contracting

Bulk buying of energy savings from project developers for multiple projects
Energy efficiency-based payments for verified savings (24/7).

Compressed Air, Ventilation, Lighting, Shower Heads, Heat Pumps, SWH etc

Large, Capital Intensive Industrial projects.

Size: >30GWh for 3 years
Market focus: Industrial

Multiple fixed rates per kWh based on time of savings
Peak 55 c/kWh
Other 10 c/kWh

Sustainability ensured by procuring energy savings over a 3 year period

16 projects
131 contracted MW
2076 GWh energy savings (over 3 years)
Pre-approved rebates for deemed energy savings (24/7) achieved through specified technologies – efficient replacements

Lighting, Shower heads, Industrial heat pumps

Small to medium projects

Size: <100kW savings
Market focus: Commercial

Standard value per rebated item, scaled to 85% of SOP
Rebate capped at R750,000

572 projects
19.7 demand savings (MW)
86.9 energy savings (GWh)
Residential Mass Rollout

Demand-based payments for verified savings.

Mixed basket of technologies including: CFLs, LEDs, Showerheads, Geyser Controllers, and Geyser blankets

Replace inefficient technologies with a pre-approved suite of energy efficient products

Size: **1MW-5MW**
Market focus: **Residential**

Fixed rate per technology as published

Sustainability ensured through product guarantees and warranties

14 projects
66 MW savings
**How can Eskom help me implement an energy efficient solution?**

### Funding Models

**Performance Contracting**
- (Industrial & Commercial)
- Custom or hybrid solution
- Limited to categories of technology on a published list
- Less than 2 month

**ESCO Model**
- (Industrial & Commercial)
- Custom or hybrid solution
- Limited to specific products on a published list
- Less than 2 week

**Standard Offer**
- (Industrial & Commercial)
- Custom or hybrid solution
- Limited to categories of technology on a published list
- Less than 2 month

**Standard Product**
- (Residential and small commercial)
- Custom or hybrid solution
- Limited to specific products on a published list
- Less than 2 week

* Pending finalisation of offer

### How much power will Your project save?

- **5 MW**
- **1 MW**
- **100 kW**
- **50 kW**

### Which technologies will you implement?

- Custom or hybrid solution

### How long is the approval process?

- 3-4 Months
- 6-18 Months
- Less than 2 month

### How and when are the rebates paid?

- **Funding Models**
  - Performance Contracting:
    - **Performance Payments** for demonstrated savings. Performance payments over contract period
  - ESCO Model:
    - **Progress Payments** based on detailed financial and technical evaluation. Payment during and on completion
  - Standard Offer:
    - **Annual Performance Payments** per technology category. Partial payment after project completion, part performance payments over contract period

- **Commissioning Date**

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(Who is it for?)

- **Industrial & Commercial**
- **Residential and small commercial**

- **Performance Contracting**
  - Published rate R/kWh for demonstrated savings
  - Performance payments over contract period

- **ESCO Model**
  - Incentive value based on detailed financial and technical evaluation
  - Payment during and on completion

- **Standard Offer**
  - Published R/kWh per technology category
  - Partial payment after project completion, part performance payments over contract period

- **Standard Product**
  - Published rate per technology
  - Full payment on commissioning

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*70% 10% 10% 10%*
CFL and sustainability

Bulk purchase and issuing of free efficient lamps to households that are distributed door-to-door or at exchange points.

Replace inefficient, incandescent lamps with an equivalent, efficient compact fluorescent lamp.

Market focus: Residential

Complete project cost (including lamp procurement and project implementation activities) covered to enable free issue.

Carbon revenue used to assist with project financing.
Solar Water Heating

Pre-approved rebates for efficient replacements

Replace inefficient geyser with a pre-approved solar water heater.

Market focus: Residential

Standard value per approved geyser
Rebate values are capped within a size band

Support National Government’s initiative to have 1,000,000 SWHs installed by 2014

Year to date (up to December 2011): 104,978
Programme to date: 172,784
Demand Response

Payment of a fixed rate for load reduction at fixed predetermined times.

Demand Market Participation (DMP) programme; Demand Response Aggregated Pilot (DRAPP) programme

**DMP**
Size: Customers with 20-80MW demand reduction potential
Market focus: Industrial

**DRAPP**
Size: Customers with <10MW demand reduction potential
Market focus: Small industrial and commercial

Multiple fixed rate per MWh
R800/MWh – R1000/MWh.
### Current Solutions

<table>
<thead>
<tr>
<th>ESCO</th>
<th>Industrial</th>
<th>Commercial / Agricultural</th>
<th>Residential</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Performance Contracting</strong></td>
<td>Process Optimisation, Lighting, Heat Pumps, HVAC etc.</td>
<td>Lighting, Shower Heads, Heat Pumps, SWH, etc.</td>
<td>Focus on Industrial Market, catering for individual projects with unique requirements</td>
</tr>
<tr>
<td><strong>Standard Offer</strong></td>
<td>Compressed Air, Ventilation,</td>
<td><strong>Lighting</strong>, Hot Water Systems, Solar, Process Optimisation</td>
<td>Target industrial, large capital projects to increase commitment and reduce risk of non-delivery</td>
</tr>
<tr>
<td><strong>Standard Product</strong></td>
<td>• Extend into industrial market</td>
<td><strong>Lighting</strong>, Shower Heads, Industrial Heat Pumps</td>
<td></td>
</tr>
<tr>
<td><strong>Downlighters Mass Roll-out</strong></td>
<td>Incorporate into SO to rationalise solutions in Commercial market</td>
<td><strong>LED Downlighters</strong>, &amp; CFL downlighters</td>
<td></td>
</tr>
<tr>
<td><strong>Residential Mass Roll-out</strong></td>
<td></td>
<td></td>
<td>Residential “Mixed Bag” of technologies</td>
</tr>
<tr>
<td><strong>SWH / HP Rebate</strong></td>
<td></td>
<td></td>
<td>HP &amp; LP Solar Water Heaters, Heat Pumps</td>
</tr>
<tr>
<td><strong>Other Mass Rollout</strong></td>
<td></td>
<td></td>
<td>CFL Sustainability and Fill-ins</td>
</tr>
</tbody>
</table>
LESSONS LEARNED

Some observations and thing we need to improve on
Lessons learned notes

• Legislative, Policy and Regulatory Issues
  – **Unpredictability** of timing/outcome results in high risk to solutions where these processes are key dependencies
  – **Potential misalignment** of anticipated legislative and policy environment with evolving incentive structures
  – **NERSA 2004 policy** focuses mainly on a demand related problem, rather than the current energy shortage
  – Challenges to amend **Eskom’s NERSA mandate** to include key market opportunities such as small scale renewables, greenfields projects, waste heat recovery and fuel switching
  – Complexities in national government **governance framework** (Policy Department, “Shareholder” and Treasury)
  – Lack of **clarity on the role of Eskom** with respect to EEDSM impacts the ability to enter into long term financial commitment beyond the MYPD2 period
  – Industry structure and **implication to municipal finances**

• Strategy
  – **Insufficient strategic framework** due to speed of implementation
  – **Too many incentive options** resulting in movement of customer uptake between offerings, resulting in implications to ESCO’s
  – Challenges to ensure **uniqueness of marketing offers**, with effective pricing structures and levels
Lessons learned notes

- **Operational**
  - Sound, project managed, **multi-functional implementation approach** required
  - Need for optimisation and automation of **business processes, systems and controls**, specifically in the transition to focus more on the Commercial and Residential markets
  - **Training of staff and advisors** on complexities of multiples incentives essential

- **ESCO Related issue**
  - Slow transformation in the **ability to contract on performance basis**
  - **Challenges to raise capital** for performance based projects
  - **Small number of large ESCOs** gain from lucrative opportunities
  - Large number of small, mostly inactive ESCOs will require **unique solutions to support ESCO development**
  - **Government and Eskom requirements** in terms of SD&L, BBBEE, cidb, LOA’s etc. impacting ESCO participation

- **Market**
  - Need for **effective marketing and communication** of incentives
  - **Fixed pricing** more successful than tendering
  - Need to manage the unintended consequences if an increasingly volatile market

- **Never underestimate the bureaucracy**
FUTURE
Emerging and Future Focus
LED technology is making strides and offer the next tier of energy improvements in lighting.

- 11 million downlighters installed
- 4.6 million in commercial/industrial market
- 3 million LED retrofits targeted
- 60 MW peak demand savings potential
- 180 GWh per annum energy (per million)

Source: http://www.blowzone.co.uk/contemporary-led-chandeliers.php
Waste heat recovery enables economic and ecological efficiency improvements

The recovery of heat and water in the production process and reintroducing these streams back into the originating process offers significant improvement to the efficiency of the operation and ultimately makes business sense as the operating costs are reduced.

67% percentage of E2PM* participants, who identified waste heat recovery as a key efficiency intervention (second most common intervention in the programme)


* Eco-Efficiency Program for Manufacturers (E2PM) that ran from 1998 to 2009.
Energy efficiency and renewable energy are key components of zero energy facilities.

Formal commitments are being made globally to pursue zero energy goals. This requires a combination of energy efficiency and small-scale renewable energy interventions. Accordingly several initiatives, including India’s Ministry of Power and Canada’s Clean Air Partnership, have broadened their definitions of DSM to incorporate green/renewable energy. Eskom IDM, in consultation with NERSA, is hoping to follow suit.
The South African Government is committed to job creation, economic development (with specific priority to the development of green industry) and aims to promote economic transformation in order to enable meaningful participation of black South Africans in the economy. It is important to note that these priorities have been incorporated into the procurement policies for the country. Details are available from:

http://bee.thedti.gov.za/

http://www.eskom.co.za/c/61/eskom-purchasing-policies/

http://www.eskom.co.za/c/63/supplier-criteria/
The South Africa’s Integrated Resource Plan (IRP) for electricity envisages that independent power producers (IPPs) and State utility Eskom will build a combined renewables base of 17,800 MW by 2030.

During August 2011, the South African Government took the first step in this multidecade clean-energy investment programme by inviting tenders for 3,725 MW of renewable capacity to be developed by independent power producers.

53 bids, representing some 2,100 MW of potential capacity, were received by the DoE during this first bidding window. On 7 December 2011 the DOE announced the first 28 successful renewable bidders for a total of 1,415.5 MW capacity. The preferred bidders named included 18 solar photovoltaic (PV) projects, eight onshore wind projects and two concentrated solar power (CSP) projects.

This round of tenders was the first of potentially 5 bidding windows. The second bidding window is currently due to close on March 5, 2012.
The Department of Energy published draft regulations on the allowance for energy efficiency savings* for public comment on 16 September 2011.

The Regulation is currently being revised to incorporate comments and recent changes in the energy policy landscape (most notably the cancellation of the REFIT which formed the basis for the calculation of the energy efficiency allowance).

An ambitious target date for the revised Regulations to be published and implemented has been set for April 2012.