Energy Efficiency Opportunities in South Africa: Commercial Sector

Eskom Integrated Demand Management

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The framework is structured as an introduction to energy efficiency, the current status of the electricity system challenges, the legal context for energy efficiency as a national priority, funding opportunities available to support energy efficiency and practical steps for implementing efficiency measures.

**The Commercial Sector component**

**Sector components**
- opportunities
- best practice
- tools

**Generic component**
- Introduction
- General context
- Funding opportunities
- Doing and audit
The focus of this information pack is to support commercial building owners or tenants (where relevant) with practical knowledge and information on energy savings and energy efficiency solutions.

The intent is to provide insight about electricity usage in the sector and to offer a range of opportunities, from those requiring no or very little spend to those requiring more significant investment, that can save energy and reduce electricity costs.
What does the commercial sector look like?

The range of commercial building uses is varied. Office buildings are the most common, but the portfolio also includes shopping centres / malls, hotels, restaurants, schools, hospitals, community centres, amongst others.
The consumption pattern for the commercial sector is typically constant throughout the day.

Average **Summer** Week Load Profile for Main Sectors

The commercial sector has a prominent impact on the characteristic shape of the summer profile.

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2011/11/09 | Source: Integrated Demand management market end-use knowledge Basc UI 240-66204213
The consumption pattern for the commercial sector is typically constant throughout the day.

The commercial sector contributes significantly to the morning peak and overall higher winter profile.

Average Winter Week Load Profile for Main Sectors

winter
The main drivers of energy use in commercial buildings are HVAC, lighting, motors and water heating.

| Source: Integrated Demand management market end-use knowledge Basc UI 240-66204213 | 7

**Commercial end use analysis**

Within the **Commercial Sector**, the largest single end-use contribution to energy consumption is from **Heating, Ventilation and Air Conditioning (HVAC)**. In addition to HVAC, lighting, motors and water heating contribute significantly and present likely opportunities for efficiency interventions.

*Other* describes a grouping of end uses that were not not individually specified, including electronic equipment.
Opportunities for greater efficiency are considered at three levels in the business:

**Behaviour change** | awareness, entrenched from leadership throughout the organisation | education, skills development | training | practical knowledge / understanding of electricity usage, systems optimisation and operation to monitoring.

**Operational measures** and interventions related to installed equipment and technologies | management plans | practices and procedures | design specifications | procurement specifications | maintenance.

**Systems and technologies**

Efficient devices and installations | efficiency upgrades and retrofits | efficient technologies |
High schools that create conservation culture save big on energy
Today @ Colorado State, Colorado State University, (September, 2010)

“In terms of energy savings, how does a public high school built in 1973 compare to a new LEED*-certified high school in the same district in the same town? In a recent study by Jeni Cross, assistant professor of sociology at Colorado State University, a 37-year-old high school in Poudre School District was able to achieve a 50 percent reduction in electricity use by changing the energy-saving behavior and attitudes of students, teachers and administrators.”  

A set of interconnected efforts can create a context of support and commitment at all levels of the organization and set clear behavioral expectations for a company culture that values conservation and sustainability:

1. **Make a company pledge.** Demonstrate leadership commitment to energy conservation and then incorporate saving goals for the company, starting from the executive level.

2. **Add energy conservation to all meeting agendas, similar to a standard evacuation briefing.** Start a meeting by checking whether any unnecessary equipment is on.

3. **Offer staff incentives.** To business areas, units, divisions or teams that save the most or to individuals who provide suggestions for savings.

4. **Communicate, communicate, communicate.** Track savings impacts (so the benefits are known) and provide feedback on progress. Have an energy meeting. Invite suggestions. Provide monthly updates and tips. Report energy savings in regular progress or annual reports.

* LEED is a certification program that provides third-party verification of green buildings.

Source: http://www.today.colostate.edu/
Sustainability is a critical success factor for energy efficiency change. Often after a few months the focus changes or drifts to other priorities, interest in the project is lost or the budget to sustain the changes is inadequate. Entrenching a culture of efficiency, continued and comprehensive communication and awareness and incorporating scheduled checks may assist in this.

“…that are not monitored and maintained typically have a six-month half-life of their benefits. That is, they lose half of their economic benefits every six months if left largely untouched.”

Emerson’s James Beall, a principal process control consultant who helps manufacturers optimize their processes.

Source: http://www.lselectric.com/energy-efficiency-process-improvements/
Minimise workplace energy use and spend with these 7 super savings tips

It is as easy as 1, 2,… 7 to be energy efficient at the office with easy, behaviour changes that are cost free:

1. Use the cold water tap rather than engaging the geyser every time.

2. When you leave the office, remember to switch off the lights.

3. Only fill kettles with as much water as you need.

4. Set air-conditioners’ average temperature in summer at 23°C and 18°C in winter.

5. At the end of the day, don’t leave your computer on stand-by; switch off the power button.

6. Be energy efficiency and change your light bulbs to energy efficient lights / CFLs.

7. Before you leave, turn off copiers, printers and fax machines at the switch. Avoid sleep mode.
**Operations and maintenance** staff are important contributors to reducing energy consumption and can assist by introducing efficient practices:

- Adjust operating schedules,
- Calibrate building controls for optimum efficiency and where possible, automate controls and introduce occupancy sensors/controls,
- Care for existing equipment, regularly inspecting, maintaining and repairing when possible to optimal functionality (e.g. clean filters or heat exchanger tubes in condensers, evaporators and boilers; check filters, dampers, coils and balance of HVAC system),
- Select efficient options/alternatives for the replacement of failed equipment,
- Make use of natural light (daylight savings or daylight harvesting)

The **Procurement division** can introduce energy efficiency principles into procurement procedures and specifications:

- Introduce minimum efficiency performance standards for equipment / appliances, replacement bulbs, etc.
- Structure maintenance service contracts with energy efficiency penalties/incentive

Introduce **training programmes** at all levels of the organisation
Conventional wisdom suggests that “you can only manage what you measure”

The value of energy efficiency in properly implemented construction standards is universally recognized as the easiest and most cost-effective way to help consumers save energy and money. Introduce processes for **Compliance to national and voluntary building, measurement and reporting standards:**

- Building codes SANS 204, 10400XA,
- M&V standards 50001 and 50010
- Energy management plan (anticipated to be introduced under the Regulations on the Mandatory provision of Energy Data)

**Measurement and reporting** ensures employees and shareholders have access to information needed to understand the energy efficiency of the building/business/premises, to identify opportunities for improvement and see the benefits of the initiatives implemented.

Commit to voluntary disclosure of energy use and/or savings (and possibly associated carbon emission reductions) in annual reports. International studies suggested that companies that voluntarily reported on their energy use and carbon emissions outperformed companies that did not.

**Retrofit with efficient systems and technologies**

**an investment in efficient change**

**Automated control.** Ensuring instituting energy management systems, such as automated control of HVAC systems and control of outdoor lighting.

**Retrofit.** Invest in an audit to accurately identify solutions aligned to the specific requirements, but indicative exchanges:

- **Water Heating** | Electrical geyser, old, inefficient or incorrectly sized boilers
- **Lighting** | Mechanic control gear, inefficient bulbs
- **Motors** | Old, inefficient or inappropriately sized motors
- **HVAC** | Inefficient options

**Heat pumps, solar water heating, combinations of these with**

- Suitable efficient alternates incl.: CFLs, LEDs, T-5 systems, electronic control gear, control systems, daylight harvesting
- VSDs, efficient motors (consider NEMA or IEC ratings)
- Evaporative AC, higher efficiency rated ACs, efficient compressors
The proof is in the …case studies considering three case studies in the commercial sector

These three commercial businesses* made significant strides towards energy efficiency with successful retrofits that demonstrated quantifiable cost savings:

### Lighting

<table>
<thead>
<tr>
<th>Old Technology</th>
<th>New Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluorescent lighting, downlights and metal halide lights</td>
<td>LED alternatives</td>
</tr>
<tr>
<td>72 x 450W and 144 x 450W mercury vapour lamps</td>
<td>158W CFLs and 125W CFLs respectively</td>
</tr>
</tbody>
</table>

### Water Heating

<table>
<thead>
<tr>
<th>Old Technology</th>
<th>New Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 year old, 2,000L resistive water geyser</td>
<td>Modular energy-efficient heat pump technology</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Capital cost</th>
<th>kWh/a savings</th>
<th>Demand Reduction</th>
<th>Annual cost savings</th>
<th>Simple payback</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>R286,801.20</td>
<td>211,000</td>
<td>66.96 MW</td>
<td>R 91,347.93</td>
<td>3.2 years</td>
</tr>
<tr>
<td>B</td>
<td>R668,950.00</td>
<td>260,000</td>
<td>55 MW</td>
<td>R225,000.00</td>
<td>3 years</td>
</tr>
<tr>
<td>C</td>
<td>R280,000.00</td>
<td>Not quoted</td>
<td>Not quoted</td>
<td>R180,000.00</td>
<td>1.5 years</td>
</tr>
</tbody>
</table>

* Source: A selection taken from *11 Eskom IDM case studies. Available from Eskom IDM.
Cleaning up the company energy act
Thinking specifically about those end uses
What to do about these energy guzzlers? practical opportunities for saving energy and costs

Commercial end use analysis

- Fans: 5%
- Pumps: 4%
- Compressors: 2%
- Lighting: 18%
- HVAC: 26%
- Motors: 14%
- Geysers: 8%
- Other*: 23%

When buying appliances (electronic, IT and kitchen appliances), consider efficiency of operation and life cycle cost.

Saving on lighting is as easy as switch off or swap out.

Saving water is good practice and saves on heating. Then there are more efficient ways of heating the water that is used.

Controlling how and when HVAC systems are operated can save significant amounts of electricity in most buildings.

Old and incorrectly sized motors are often cost effectively adjusted with a VSD.

Source: Integrated Demand management market end-use knowledge Basc UI 240-66204213
Energy efficient HVAC systems … offer a key to significant energy and cost savings

1. Adjust blinds and curtains in rooms that receive direct sunlight; this helps to keep rooms cool and postpone switching on air-conditioners.

2. Close windows while air-conditioners are running.

3. Don’t cool empty space; only switch on air-conditioners when rooms are occupied.

4. Switch off units 30 minutes before leaving the office.

5. Set air-conditioners’ average temperature in summer at 23°C and 18°C in winter.

6. Create awareness amongst employees and individuals responsible for the control of HVAC systems that are not controlled via a building management system.

7. Conduct proper maintenance to ensure all HVAC system components are intact and work efficiently; including motors, pumps, fans, compressors, ducting and filters.

8. Consider replacing old systems. New, energy efficient systems offer enhanced control functionality and higher levels of energy efficiency.

9. Use air-conditioner fans to draw in and circulate cool air from outside during early morning hours.

10. Set air-conditioners to circulate cool air instead of drawing in warmer air from the outside.
Reach for the stars, ...or leaves, ...or green globes

Rating systems and tools
If you are going to all this trouble, get rated and enjoy cost, environmental and marketing/CSR benefits

“Green certification must add value to all, not become a souvenir trinket from hell.”


There are a host of rating tools and accreditation options in the market. Some are industry specific (e.g. hospitality industry), some rate the building design and construction while others consider tenancy behaviour and operation. Some rating tools only assess and rate new building designs, while others also rate existing buildings.

Some require significant paperwork, reporting and compliance with stringent international standards, while others are practical and inexpensive. Some are well known, globally recognised and prestigious, while others may be less well known, while offering similar benefits or focused on the local market at lower costs. **Give some thought to the most appropriate rating system for your company.**
Quick view of the most prominent rating systems (…1)

<table>
<thead>
<tr>
<th>Rating system</th>
<th>Description</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Green Building Council South Africa (GBCSA): GreenStar rating.</strong></td>
<td>The greenstar rating assesses 11 categories including energy use and can allocate up to 6 stars. Currently only rate new buildings, but the Council is developing tools for existing buildings. Note: The South African GBC adopted the green star rating from Australia because of climatic similarities. Other GBCs have selected other rating systems better suited to their environment.</td>
<td><a href="http://www.gbsca.org.za">www.gbsca.org.za</a></td>
</tr>
<tr>
<td><strong>Green Leaf Rating.</strong></td>
<td>Initiative of the Hotel Association in Canada, offering a free rating system based on a self assessment of four categories: energy conservation, resource conservation, environmental management and pollution prevention. Can earn up to 5 leaves. (Canada)</td>
<td><a href="http://www.topcanadianhotels.com/green_hotel_ratings.html">http://www.topcanadianhotels.com/green_hotel_ratings.html</a></td>
</tr>
<tr>
<td><strong>NABERS.</strong></td>
<td>The National Australian Built Environment Rating System is a national rating system measures the energy efficiency, water usage, waste management and indoor environment quality of a building or tenancy and its impact on the environment. Provides tools to conduct a self rating, but requires accredited assessment/rating. Costs available on website. (Aus)</td>
<td><a href="http://www.nabers.gov.au/public/WebPages/Home.aspx">http://www.nabers.gov.au/public/WebPages/Home.aspx</a></td>
</tr>
<tr>
<td><strong>BREEAM.</strong></td>
<td>Building Research Establishment Environmental Assessment Methodology is the eldest and most widely used method of assessing, rating and certifying the sustainability of buildings. Nine categories. Relevant to existing and new buildings. 200,000 buildings certified globally. (UK)</td>
<td><a href="http://www.breeam.org/">http://www.breeam.org/</a></td>
</tr>
<tr>
<td><strong>The Green Globes.</strong></td>
<td>This system is a new, innovative building environmental design and management tool that delivers an online assessment protocol, rating system and guidance for green building design, operation and management. It is interactive, flexible and affordable, and provides market recognition of a building’s environmental attributes through third-party verification.</td>
<td><a href="http://www.greenglobes.com/home.asp">http://www.greenglobes.com/home.asp</a></td>
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<td><strong>BERDE Green Building Rating System</strong></td>
<td><em>Building for ecologically responsive design excellence.</em> The BERDE Green Building Rating System is developed under the BERDE Program. It is a tool to measure, verify and monitor performance of buildings above and beyond existing mandatory building and environmental regulations and standards. (Phillipines)</td>
<td><a href="http://berdeonline.org/">http://berdeonline.org/</a></td>
</tr>
<tr>
<td><strong>German Sustainable Building Certification</strong></td>
<td>The <em>German Sustainable Building Certification</em> covers all relevant topics of sustainable construction, and awards outstanding buildings in the categories bronze, silver, and gold. Six subjects affect the evaluation: ecology, economy, social-cultural and functional topics, techniques, processes, and location. Relevant to new buildings.</td>
<td><a href="http://www.dgnb.de/en">http://www.dgnb.de/en</a></td>
</tr>
<tr>
<td><strong>LEED Certified.</strong></td>
<td>The <em>Leadership in Energy and Environmental Design (LEED)</em> Rating system is supported by the US Green Building Council. Relevant to existing and new buildings, building envelope or O&amp;M. Consist of a combination of credit categories and presents the rating on a scale from certified to platinum. Applied globally. (US)</td>
<td><a href="http://www.usgbc.org/leed#rating">http://www.usgbc.org/leed#rating</a></td>
</tr>
<tr>
<td><strong>Lotus Rating System.</strong></td>
<td>LOTUS Rating Tools are based on existing rating systems (LEED from the US, BREEAM from the UK, Green Star from Australia). Based on an assessment across several categories a certified, silver, or gold rating can be awarded. (Vietnam)</td>
<td><a href="http://www.vgbc.org.vn/en/lotus/lotus-vn-rating-tool/">http://www.vgbc.org.vn/en/lotus/lotus-vn-rating-tool/</a></td>
</tr>
<tr>
<td><strong>Texas A&amp;M University’s Sustainability Tracking Assessment and Rating System™ (STARS)</strong></td>
<td>Texas A&amp;M University’s Sustainability Tracking Assessment and Rating System™(STARS) is a transparent, self-reporting framework for colleges and universities to measure their sustainability performance. STARS® was developed by AASHE with broad participation from the higher education community.</td>
<td><a href="http://sustainability.tamu.edu/stars.aspx">http://sustainability.tamu.edu/stars.aspx</a></td>
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Quick view of the most prominent rating systems (...3)

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<tbody>
<tr>
<td>Green Key Eco Rating.</td>
<td>A comprehensive environmental self-assessment focussed on operational issues. Hoteliers are awarded a 1-5 Green Key rating and provided with guidance on how to &quot;unlock&quot; opportunities to reduce environmental impacts and operating costs through reduced utility consumption, employee training, and supply chain management.</td>
<td><a href="http://www.hotelassociation.ca/site/programs/green_key.htm">http://www.hotelassociation.ca/site/programs/green_key.htm</a></td>
</tr>
<tr>
<td>Five-Leaf System</td>
<td>The <strong>Five-Leaf System</strong> rates the hospitality industry that value eco-performance including the management of hotels and other lodgings. Global coverage.</td>
<td><a href="http://fiveleafsystem.com/">http://fiveleafsystem.com/</a></td>
</tr>
</tbody>
</table>
Thank You