Energy efficient lighting system implementation

In 5 Eskom buildings – North Western region

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This article focuses mainly on Eskom's internal energy efficiency lighting project implementation, and some challenges encountered during the process.

Electricity demand in South Africa has increased to unprecedented levels forcing everyone in the country to have an attentive approach to energy efficiency. Eskom, through the Energy Efficiency Demand Side Management (EEDSM) programme encourages all its customers to conserve power and electric energy. Eskom decided to lead by example by introducing the 'Billion kWh' saving programme. This programme focuses on Eskom's Internal Energy Efficiency (IEE) drive to implement energy efficiency internally in Eskom facilities (eg Eskom owned and rented buildings, power stations and substations).

Lighting in Eskom buildings is one of the critical elements that is mentioned in the Eskom IEE procedure and it was therefore decided to target this component to implement the first IEE project in the North Western region.

Of 69 buildings in the region, five larger buildings were selected to be retrofitted with energy efficient lighting technology and motion sensors. The purpose of the project was to improve energy efficiency of these buildings which are located across the region as indicated:

- Eskom Centre – Bloemfontein
- Freepen – Bloemfontein
- Customer Service building – Benoni
- Trust Centre – Kimberley
- Blanckenbergvlei – Kimberley

IEE targets

The target of 1 billion kWh (1 000 000 000 kWh) of energy savings by 2015 is shared among all Eskom divisions, regions and facilities. This project forms part of this initiative. The national IEE target for the 2010/11 financial year for all Eskom regions is shown in *Table 1*:

Target	MW	GWh
National	8	24
Distribution	1,67	5
Region (NWR)	0,17	0,5

Table 1: Eskom national target.

Measurement & Verification

Measurement & Verification (M&V) was carried out in 15 buildings in the NWR from 69 buildings; the remaining buildings could not be included in the baseline as the data obtained was not sufficient or adequate (eg incorrect bills, estimations of consumption, etc). *Figure 1* represents the baseline for the mentioned 15 buildings in NWR. Monthly energy consumption (kWh) and temperature data were obtained and used to establish the relation between the energy used (Eskom monthly bills) and temperature (M&V report) for each building. In this way the behaviour of buildings under certain conditions should first be understood.

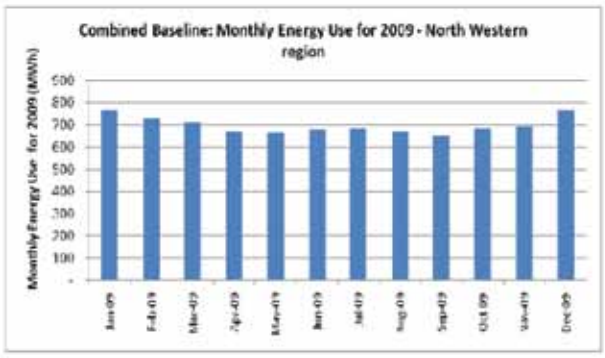

Figure 1: Combined baseline for 15 Eskom buildings NWR.

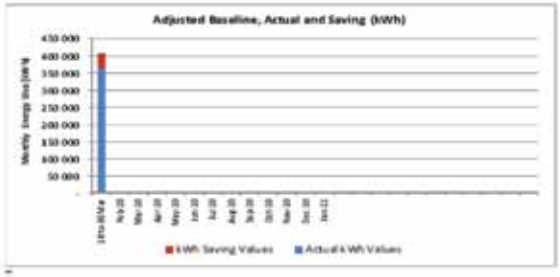

Figure 2: Energy saving over period of 12 days for three completed buildings.

Baseline development and performance assessment

The monthly energy consumption (kWh) and temperature data was used to obtain the relation between the energy use and temperature for each building with available data. This relation was used to develop the baselines for each building from January 2009 to date of implementation. The relation between energy consumption and temperature data received from the South African Weather Services (SAWS) was used to construct the baseline for the five buildings. The following assumptions were made during the baseline development process since data obtained was not all accurate:

- Accuracy of baseline results depends on the availability and number of monthly bill data, ie nine to 12 bills were used to develop a baseline and presented fairly accurate results given four scenarios of how buildings behave when heating, cooling and both heating and cooling as shown in *Figures 3 – 5.*

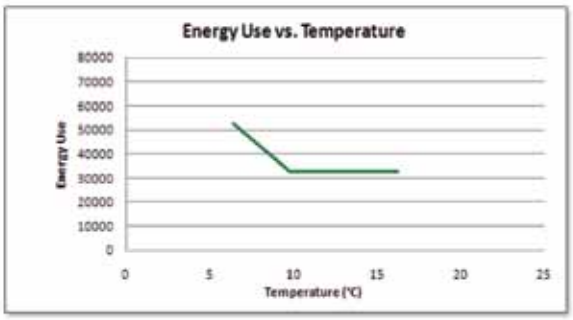

Figure 3: Building behaviour- only heating done in building.

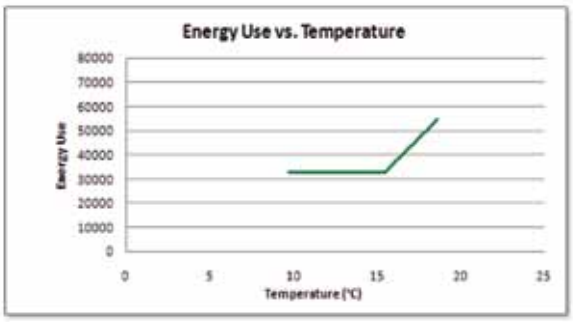

Figure 4: Building behaviour- only cooling done in building.

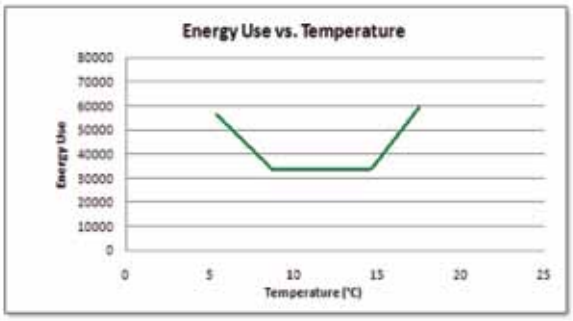

Figure 5: Building behaviour- both heating and cooling done in building.

- Energy meter data provided before and after implementation Performance assessment results were received and based on the 12 day period (18 – 30 March 2011). The three buildings (Eskom Centre, Freepen and Customer Service building) out of the five contracted buildings for retrofits were completed, measured and verified.

The findings as per the M&V performance assessment report for the 12 day performance assessment on three completed buildings shows that the energy consumption is reduced by 10%. *Figure 2* reflects the overall savings achieved over 12 day period (18 – 30 March 2011).

Demand and energy saved during the 12 day period was 0,141 MW and 40,672 MWh. From the achieved savings the annual demand and energy reduction will be 0,141 MW and (3,38 x 365) = 1,237 GWh respectively. Even though only three buildings (out of five contracted) were completed, the NWR managed to exceed the set target on energy saved (247%) and performance of 82% on demand reduction was achieved against the regional target of 0,17 MW (see *Table 1*).

Technology overview

Replaced lighting system

The old lighting systems were:

- T8, 36 Watt x 3 tube (4 feet) magnetic ballasted recessed light fittings
- 36 Watt x 2 tube magnetic ballasted open channel fittings

Implemented technology

The new installed energy efficient light system is:

- T5, 28 Watt x 2 tube (four feet) electronic ballasted recessed lights fittings
- 28 Watt x 2 tube electronic ballasted open channel fittings
- Motion sensors

The passive infrared (PIR) sensors (CMR PD10, IS 360D, IS3360, 10100) were installed in three Eskom buildings to switch off both the lights and air conditioners (split systems only) when offices are vacant.

Challenges

During the execution of the project a few challenges were encountered as result of various factors. These factors included the use of a hybrid project process, safety, access to the offices, employee complaints, storage and disposal.

Project process

The process used to implement the project was a hybrid of the Demand Side Management (DSM) and Capital Investment Process (CIP). Elements of the two processes were combined for successful execution of the project.

Safety

The Eskom safety requirements are fairly onerous and some development work had to be performed by the contractor to improve compliance. This resulted in a delayed start of the project.

Access to closed offices

The plan was to work during the day in the offices, boardrooms, open areas and pass ways. Offices were occupied during the day with some locked and this caused a delay as it was disorganising the project schedule.

Employee complaints

- Some employees did not allow the work to be done in their offices in their absence, others complained about the disruptions, eg noise, dirt etc.
- On completed offices they complained about too intensive lighting, headaches and eye problems.

Storage of new and old luminaries

Storage of 1 600 new lights was required taking into consideration the old luminaries replaced needed to be stored and disposed safely.

Lessons learnt

- Through communication, the mandate should come from higher authority to all employees at ground level to understand the importance and significance of energy efficiency (ie the involvement of all managers) so as to eliminate the negativity and obtain support from employees.
- The successful implementation and execution of a project of this nature, requires properly defined processes, clearly defined technical specifications and detailed analysis and evaluation of the project proposal.

Conclusion

The successful implementation of this Internal Energy Efficiency project supports the objective of the Eskom Billion kWh programme. The execution of the project provided valuable practical lessons that can be shared with others in the EEDSM fraternity. Eskom, through the implementation of similar projects, will achieve its goal to 'lead by example', and encourage others to save energy. An additional benefit is the awareness created for energy efficiency and power conservation with Eskom employees.

Bibliography

[1] Eskom Internal Energy Efficiency Procedure Unique identifier: 32- 523 revision [2] Measurement &Verification - UJ M&V, Scope Plan baseline NWR, 5 Major buildings.

[2] Eskom IDM websites: www.eskom/idm.co.za; www.eskominternalenergyefficiency.co.za

Abbreviations

CIP – Capital Investment Process
DSM – Demand Side Management
EEDSM – Energy Efficiency Demand Side Management
IEE – Internal Energy Efficiency (Eskom)
M&V – Measurement & Verification
NWR – North Western Region (South Africa)
PIR – Passive Infrared
SAWS – South African Weather Service

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