South African
Industrial Energy Efficiency Project

Case Study (EnMS)

Company name	The Standard Bank Global Leadership Centre					
Size of company (Based on the energy consumption bill)	SMME (R 250k –R 750k)		**Medium** (R 750k –R 24 mil)	√	Large (Above 24 mil)	
Sector	Commercial Building, Financial Services					
Location	Johannesburg, South Africa					
Company contact	Name: Braam Dalgleish,			Position: SBSA Energy manager		
	Email: braam.dalgleish@standardbank.co.za			Telephone: +27 11-636 6647 / Mobile +27 (0)83 384 5235		
Year joined project	2015					
Date of implementation	2015-2107	Duration 2.5 years		30 months		
Utility intervention	Energy management system(EnMS) implementation and certification					
Case study author	Wendy da Cruz (dacruz@mweb.co.za)					
Project manager	Sashay Ramdharee (SRamdharee@csir.co.za)					

1. BACKGROUND

1.1 Company profile

Standard Bank Group's (SBG) strategic vision is to build the leading Africa focused financial services organisation using their competitive advantages to the full. Supporting the vision, they realise that their business needs to grow sustainably within the constraint of a reliable energy supply, a commodity in scarce supply within the African continent. In line with their vision, they made a commitment to actively reduce energy consumption at all their facilities, with an aspirational target of 11% electricity reduction by 2020. This goal is aimed to be achieved by implementing and operating an energy management system (EnMS) based on international accepted standards.

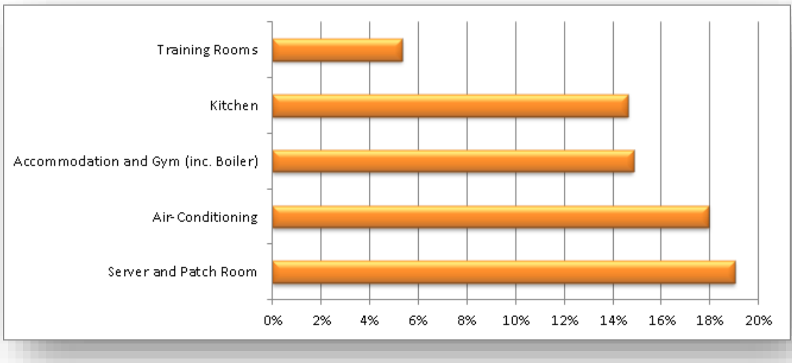
The Global Leadership Centre (GLC) was ear-marked as the first facility in the portfolio for implementing an ISO50001 EnMS. Rated as one of the top 10 energy consumers in the portfolio, the intent of selecting this facility was to build on its training capabilities, develop energy leaders for the Bank and to expand the energy management activities to other facilities in the 1.1 million square meter portfolio.

1.2 Plant profile

The GLC is a facility owned and operated by the Standard Bank of South Africa (SBSA) and is located in Morningside, Johannesburg. The facility was expanded and revamped in 2006 and has a total floor area of more than 25 674 m².
Its primary function is a hotel and training facility which hosts training and conferences for Standard Bank staff.
The GLC boasts an impressive range of facilities, including an auditorium, lecture rooms, library and technology facilities, lounge and dining room.

The site also operates management systems such as an environmental management system (ISO 14001) and an occupational health and safety management system (OHSAS 18001) for which it has been certified. The scope of the EnMS covers all areas and equipment located on the premises of the GLC. Electricity is the primary source, with small volumes of diesel used only for two backup generators which operate during electricity failures.

Areas of significant electricity consumption



The nature of the activities at the GLC results in electricity being consumed in:

- Lighting
- HVAC
- Information technology (IT)
- Domestic water heating
- Kitchens
- Laundry.

1.3 Nature of the challenges

Managing and reducing the corporate's energy consumption is essential to being an environmentally responsible business. The decision to develop and implement an EnMS is driven by material issues such as:

1. Rising costs of energy supply.
2. Security of energy supply. South Africa was plagued by load shedding in 2008 and 2015. Standard Bank, as a bank, plays an important role in the South African economy and is committed to contributing towards ensuring the South African energy supply security.

3. Environmental impact and reputation. The South African power pool generates by far the most of electricity from coal based sources. Standard Bank can improve their energy efficiency to reduce electricity consumption thereby minimizing their environmental impact.

1.4 IEE capacity building programme

Braam Dalgleish, the Standard Bank Group Energy Manager, participated in the National Cleaner Production Centre South Africa (NCPC-SA) and United Nations Industrial Development Organisation (UNIDO) industrial energy efficiency (IEE) phase 1 EnMS expert programme in 2014 prior to joining SBG, and applied the principles to the GLC project.

In addition, as part of the EnMS ISO 50001 certification, NCPC-SA conducted a certification readiness audit, which the GLC team reported was, "Extremely helpful in preparing us for the certification audit".

Subsequent to the success of the GLC project, additional SBG energy department members, three in total, have embarked on round five EnMS expert programme, with an additional two booked for round six.

2. KEY ACHIEVEMENTS

Key findings table

Implementation period (yyyy-yyyy)	2015 to 2017
Total number of projects	Seven
Monetary savings in ZAR	1 248 350
Energy savings in GJ	5 135 GJ
Total investment made ZAR	5 392 592.00 (of which 4 600 000 was for the solar PV)
Overall % of total consumption saved	11.8%
Total savings from no cost interventions	2 195 GJ
Payback time period in years	4.99 With solar 0.87 Without solar
GHG emission reduction (ton CO_2e)[1]	1 486.23
Number of females employed prior to implementation	50% of the EnMS implementation team were females
Number of females employed after implementation	No change

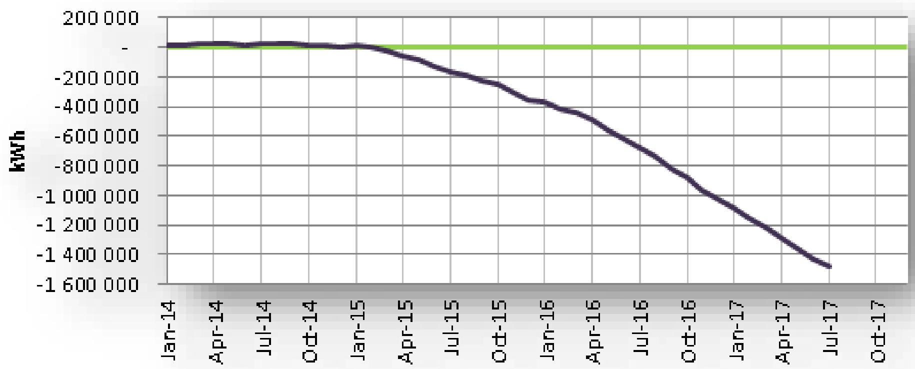
During the first period of implementing the EnMS, savings were achieved primarily through operational changes, changing boiler and air-conditioning set points, and switching off unnecessary equipment. This resulted in a reduction of 7.3% without any capital expenditure.

[1] SA Grid kWh to CO_2e Conversion Factor set at 1.0245 as per the UNIDO/GEF .
[2] Should the kWh rate be unknown use R0.84c /kWh

In 2016, the effect of installing the heat pump installation was experienced as the connection of a 203 kWp solar PV plant in November 2016 was implemented.

The majority of savings were realised solely through the implementation of an EnMS aligned with ISO 50001, and by applying the principles of continually looking for saving opportunities, systematically implementing them, and finally and most importantly, by ensuring the systematic management of energy to sustain the gains.

The following CUSUM graph shows that electricity consumption was lowered by more than 1,400,000 kWh (5000GJ) since the beginning of 2015.



3. IMPLEMENTATION OF AN ENERGY MANAGEMENT SYSTEM

3.1 The E-Team

The development and implementation of the EnMS was done mainly by internal people based at the facility with support from the energy and engineering team from corporate head office. The resources made available included energy managers, energy engineers, lighting and HVAC specialists, and sustainability experts.

The team comprised of people qualified as mechanical, electrical, or chemical engineers including technicians and PhD graduates. It included an association of energy engineers (AEE) certified energy managers (CEM), energy auditors (CEA), and measurement and verification professionals (CMVP).

The Core E-Team showing off the SABS certificate and AEE Award

3.2 Energy policy

An energy policy was drafted and approved by top management to demonstrate their commitment toward implementing an EnMS and ongoing support to achieve energy performance improvements.

3.3 Energy Review

Implementation of the EnMS started off with an energy review to identify areas of significant uses. Once areas of significant energy use (SEU) are identified, the areas can be assessed in detail to identify energy savings opportunities.

Total electricity consumption
Knowing the total electricity consumption is important as it guides the team towards potential financial, technological, and human resource needs and allocation for the project.

The baseline
Determining a baseline is crucial to demonstrate the success as well as the sustained energy performance of the implemented EnMS. The baseline is defined as a prediction of what the energy consumption would have been under the same circumstances in the absence of any energy management improvement activities.

For the purposes of the EnMS at the GLC, option C as per the international performance measurement and verification protocol (IPMVP) was used. This provides a baseline for the total facility based on 2014 consumption data. The optimal baseline equation for the GLC included ambient temperature (using HDD heating degree days) and bed occupancy, as follows:

$$kWh_{monthly} = 338.97 \times HDD + 31.03 \times BedOcc + 287399$$

Energy performance indicators
Energy Performance Indicators (EnPI) were developed to demonstrate, quantify, and show sustained electricity consumption savings. Two important EnPIs for the GLC are:
- Baseline versus actual.
- Cumulative sum of all the difference between the baseline and the actual (CUSUM)

3.4 Training and communication

Communicating information regarding the effectiveness of the EnMS is done through information sharing, daily communication, meetings, surveys, awareness training / toolbox talks, internal audits, continual improvement and corrective and preventative action processes.

Training needs were assessed using various energy management indicators, including
- EnPIs
- Trend and root cause analysis
- EnMS system audits
- Outcomes of assessments
- New ideas from employees
- Minutes of meetings.

Wherever possible, amendments to the existing schemes were done.

Information sharing is used to distribute broad based information to a wide audience. Feedback is not required and the intention is only for information sharing. Channels in use include newsletters, notice boards, dashboards, and campaigns.

3.5 Maintaining performance and dashboards

Daily evening manager on duty (EMOD) reports are vital documents to ensure issues encountered during the evenings are communicated to the day managers. These reports are also a key communication medium from the day managers (who establish set-points) to night managers to ensure set-points are controlled as documented in the EMOD reports.

Dashboards are valuable tools utilised to ensure the facility is efficiently operated from an energy point of view. These dashboards include high level real time energy performance assessment tools that are easy to use and show energy intensity, electricity consumption, and maximum demand.

4. IMPLEMENTATION CHALLENGES

For the management system implementation it was found that it is fundamentally a change that requires everyone to be brought on board. The EnMS at the GLC was developed and integrated with the existing ISO14001 and 18001 management systems. This meant that the framework for EnMS was already in place. In addition, the application of the simplified Excel based tool developed by UNIDO EnMS spreadsheet was most beneficial. Other in-house tools used were business case tools and an online monitoring system.

For energy savings interventions non-technical interventions, focusing on the significant users of energy, were found to be quicker to implement realising improved efficiency in a shorter time. Savings came from the inclusion of operational personnel from all areas of the facility in the energy team, education of personnel on correct energy management, communication to all areas of the facility on the importance of managing energy and regular engagements.

5. HIGHLIGHTS OF OPERATIONAL/ESO INTERVENTIONS

5.1 Summary of all interventions

Energy uses/users	Energy sources	Intervention	Utility saving period	Investment (ZAR)	Savings (ZAR/year)	Payback (Yrs.)	Utility saving (Units) GJ	GHG emission reduction (tonnes CO_2e/year)
2015 Projects								
Water heating	Electricity	Install low flow showerheads	2015	70000	97455	0.72	1273	368.63
Water heating	Electricity	Install heat pump	2015	425600	212901	2.00		
Space heating	Electricity	Switch off underfloor heating in summer. reception area.	2015	0	39420	-		
Renewable	Solar	Solar PV	2015	4600000	236617	19.44		
HVAC	Electricity	Switch off chiller that is not needed.	2015	0	286890	-		
TOTAL (from 2015 projects; balance from operational optimisation, behavioral based savings)				**R 5095600**	**R 873283**	**5.83**	**1273**	**368.63**
Total 2015 saving, using baseline regression against 2014: 353 513 kWh / 1273 GJ (12 months)								
2016 Projects								
Lighting	Electricity	Office lighting retrofit	2016	296992	278616	1.07	2409	697.60
Lighting	Electricity	Develop lighting standardization documents for GLC	2016	0	No direct savings	N/A		
Lighting	Electricity	Stationary store room lights + staff passage. lights to be switched off.	2016	0	13068.03	0		
TOTAL (from 2016 projects; balance from operational optimisation, behavioral based savings)				**R 296992**	**R 291684**	**1.02**	**2409**	**697.60**
Total 2016 saving, using baseline regression against 2014: 669 221 kWh/ 2 409 GJ (12 months)								
2017 Savings								
	Electricity		2017				1453	420
Total 2017 saving, using baseline regression against 2014: 403 592 kWh / 1 453 GJ (6 months)								

5.2 Details of highlights

Boiler (water and space heating)

Various opportunities have been implemented to improve energy performance including:

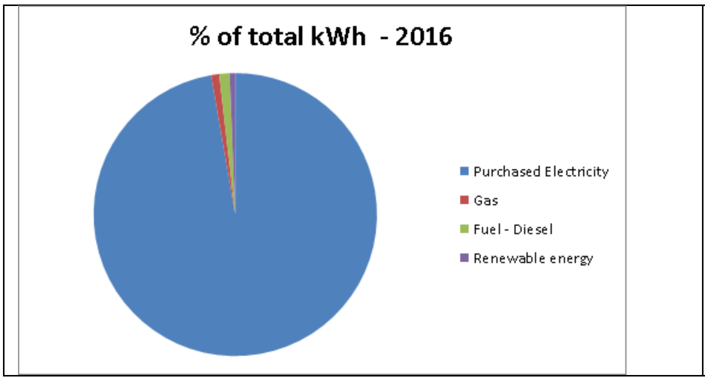
- Supplying domestic water at 55˚C instead of 60˚C.
- Switching off the boiler during extended unoccupied times.
- Insulating hot water supply pipes.
- Install flow restrictors in the showers.
- Heat pump installation at end 2015.

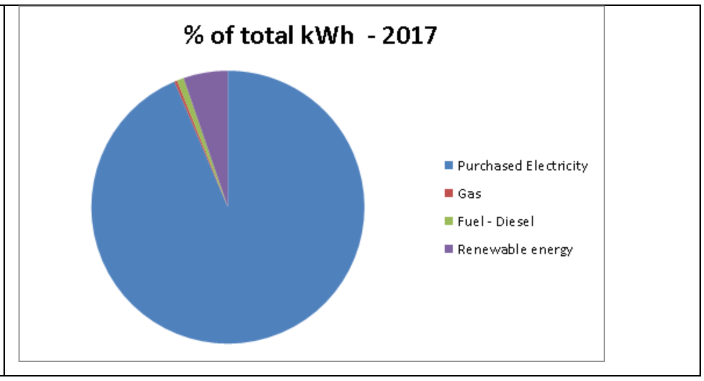
Heating, ventilation, and air-conditioning

The HVAC system comprises of three chillers of different sizes. The building management system controls the chillers to meet the current thermal demand of the facility. Therefore, a small chiller will operate on a cool day with the biggest chiller only in operation on a very hot day and when the facility is fully occupied. A problem was picked up on investigation as to why the chillers could not achieve the required temperature drop across the evaporator as expected. A strainer was found to be incorrectly installed which restricted water flow to the cooling towers resulting in insufficient heat transfer.

Renewable energy successes

The solar PV plant was installed during 2016 and showed the following





Energy Sources	% of total kWh (2016)	% of total kWh (2017)
Purchased electricity	97.26%	93.59%
Gas	0.93%	0.33%
Fuel - Diesel	1.18%	0.81%
Renewable energy	0.64%	5.27%

6. BENEFITS AND LESSONS LEARNED

6.1 Benefits

This facility is the first ISO 50001 certified commercial facility in Africa. The certification was done by a local certification board, i.e. the South African Bureau of Standards (SABS) which was not accredited by the local accreditation board, i.e. South African National Accreditation System

(SANAS). The certification of this facility was used by the SABS as their example to extend their scope to certify other commercial facilities in Africa.

The project was also awarded the Sub-Saharan Energy Project of the Year by the American Association of Energy in 2016.

The key lessons learnt can be summarided as follows:

- Management and operational teams support is essential. Without support from other teams', including management teams, the management system is destined for failure.

- Significant savings can be achieved through operational and maintenance awareness (No or low capex required). Changing boiler and air-conditioning set points, switching off unnecessary equipment, reduced electricity consumption by 353 513 kWh in less than ten months and without any capital expenditure.

- Readily available data and information are vital for successful energy management as it aids in decision making and also monitoring and tracking of impacts.

- Teams with the relevant expertise were involved in different stages of implementation and execution of the management system. People with appropriate skills and expertise were used for procedures development, project identification, and evaluation of financial and technical viability of projects, project management, implementation, and verification of savings.

6.2 Benefits

- Improving energy performance: Knowing how much and where electricity is consumed leads us to areas where we should focus on with detailed energy assessments.

- The learnings and experiences gained from implementing the energy management system at the GLC facility will be used to train energy leaders to implement a similar system at their facilities.

Quotes:

"It's not really a target, it's a guide – the goals are continuously shifting, and we are continuously improving."
—Keith Cassie, Senior Manager: Engineering and Energy Management

"We have been able to chart a clear way forward with our energy strategy and have developed meaningful targets for energy savings over our million plus square meter portfolio."
—Nkosinathi Manzana, Head of Professional and Technical Services

"This achievement wouldn't have been possible without the hard work and dedication of the energy team."
—Mongezi Nosenga, Facilities Manager.

"Energy performance indicators, such as the CUSUM-graph, are excellent tools to gauge facility energy performance improvements in one blink."
—Braam Dalgleish, Energy Manager

7. FUTURE PLANS

Energy management system roll-out

- The learnings of the system at GLC led to the management decision of implementing the same at three additional significant energy using facilities in the portfolio.

Sub-metering and individual objectives, targets and KPIs

- The GLC has installed sub-metering for the significant energy uses and is developing a history of consumption. Going forward the intention is to use these to manage individual areas.

Extension of the EnMS principles to water management

- During 2017, the GLC took the decision to apply the EnMS approach to the management and improvement of water performance.