Industrial Energy Efficiency Project in South Africa

Case Study–EnMS

Company Name	AIRPORTS COMPANY SOUTH AFRICA PTY (LTD) (King Shaka International Airport)
Sector	TRAVEL
Year Joined IEE Project	2012
Year of Interventions	2010 - 2013
Contact Person	JERUSHA JOSEPH
Key Focus Areas of Intervention	LIGHTING AND HEATING VENTILATION AND AIR CONDITIONING (HVAC)SYSTEMS

1. BACKGROUND

1.1 Company Profile

Airports Company South Africa Limited (ACSA) was formed in 1993 as a public company under the Companies Act of 1973(as amended) and the Airports Company Act of 1993(as amended). Although ACSA is majority owned by the South African Government, through the Department of Transport, the company is legally and financially autonomous and operates under commercial law.

In a country that is plagued by chronic unemployment, ACSA is pleased to be contributing to job creation in South Africa, achieved through infrastructure investment and the partnerships that they develop with the private sector. It is estimated that the three major international airports sustain about 300 000 jobs (direct and indirect) and that planned future developments, as a result of passenger and cargo growth, will result in the creation of some 150 000 new jobs over the next 10 years, provided the envisaged infrastructure development plans are realised.

ACSA was formed to own and operate the nine principal South African airports, including the three main international gateways of O.R. Tambo, Cape Town and King Shaka International Airports. As well as providing world class, secure infrastructure for airlines to transport people and goods, ACSA extends its responsibilities to include the promotion of tourism, the facilitation of economic growth and job creation, and protection of the environment. King Shaka International Airport is the major airport in the city of Durban, South Africa. The airport opened its doors to the general public on 1 May 2010, a month before the beginning of the 2010 FIFA World Cup which was hosted by South Africa. King Shaka International Airport replaced the existing Durban International Airport that was decommissioned upon the opening of the new airport which cost R6.8 billion.

It's world class facility offers a host of features to make the travelling experience as comfortable and pleasurable as possible. Shops and restaurants, a bank and post office are just a few additional features King Shaka International Airport has to offer. King Shaka International is said to be three times bigger than the old Durban International airport and have five times as many shops.

STATISTIC	THE OLD	THE NEW
Runway length	2,4km	3,7km
Aircraft parking bays	23	34
Air bridges	None	16
Annual passenger capacity	4 400 000	7 500 000
Check-in counters	52	72
Common-use self-service kiosks (CUSS)	4	18
Passenger terminal building floor area	30 000m²	102 000m²
Retail space	2 900m²	6 500m²
Retail outlets	23	52
Public parking bays	2 490	6 500

Figure 1: Comparison between old and new airport capacities.

1.2 Plant Profile

King Shaka International Airport, situated about 35km north of the Durban City Centre, joined the Industrial Energy Efficiency Project in 2012 as a Candidate Plant in Energy Management Systems (EnMS).

The terminal building of King Shaka International Airport is approximately 103 000 square meters and is serviced by an air conditioning plant with chiller cooling duty capacity of 9MW which provides cooling to the terminal building. All other buildings on-site are serviced by separate air-conditioning decentralized systems. King Shaka International Airport also has a significant amount of lighting in the Terminal building and in more than 30 other buildings on site, which is equivalent to an excess of 60 000 square meters in total. This however excludes the public areas and open car parks. The airport also has specialized lighting such as runway edge lights which span over the 3.7km length as well as Precision Approach Path Indicators(PAPI) which provide guidance for aircraft landing and take-offs and serve as a visual aid to pilots. The Precision Approach Path Indicators are also responsible for lighting the taxiways, airside roads and apron bays (where aircrafts dock).

Some of the other energy users on-site are the various pumps that are used for various applications. Jet A1 Fuel is circulated to the Apron from the 6million litre storage capacity Jet A1 Fuel Farm. Potable water is circulated to King Shaka International Airport from an onsite reservoir via a booster pump station down the water reticulation system Bulk water supply line 11.25km long.

Sewerage is treated onsite by two Waste Water treatment Plants located North and South on the King Shaka International Airport Site.

1.3 Nature of Challenges

King Shaka International Airport is the first green-field airport in South Africa in the last 50 years and was opened on 1st May 2010 with state of the art facilities in line with current technologies. There has since been a consistent drive to save energy, specifically by reducing electrical demand for air conditioning and lighting on-

site. Initially, the driver for the reduction of energy consumption emanated from energy improvement targets that were committed to. The magnitude of the challenge quickly increased as the anticipated exponential increase in electricity tariffs became a reality and it subsequently became an organizational Key Performance Indicator. It was then that the idea of an Energy Management Functional Structure was borne and managing energy in a sustainable manner became realisable.

The Industrial Energy Efficiency Project, implemented by UNIDO through the NCPC-SA, was identified to be an ideal mechanism to further develop and implement the concept of managing energy in a sustainable manner. With the support of the organizations top management, which is a key ingredient to successful energy management system implementation, KSIA then signed up as a candidate plant for the EnMS expert level training.

1.4 IEE Capacity Building Programme

KSIA has also taken the opportunity to further capacitate employees in the area of energy efficiency by participating in various training workshops for systems optimisation and energy management system implementation. The Expert Level Energy Management System Training was training completed by KSIA's Mechanical Engineer. The training was split up into three phases over a period of 14 months and KSIA acted as a host plant in Phase 3 of the training, thereby allowing the group of expert candidates to use their site as a practical learning facility for the internal audit component.

Other key management personnel from all site operations departments also participated in a half day Energy Awareness workshop.

The workshop helped to raise awareness around energy efficiency and highlighted the need for an Energy Management System which would become an integral part of airport operations. The drafting and signing of the Energy Management Policy, with the support and commitment of the highest tiers of the airports management, was pivotal to disseminating the message of energy efficiency.

2. KEY ACHIEVEMENTS

Key findings table

Implementation Period (yyyy-yyyy)	**2010 - 2013**
Total Number of projects	**3**
Annual Monetary savings in ZAR	**2 761 249**
Annual Energy savings in KWh	**1 932 756**
Energy Saving %	**6**
Total investment made ZAR	**400 641**
Payback time period in months	**1.8**
Annual GHG Emission Reduction (tons CO2)[1]	**1850**

The case study concentrates on the lighting and air conditioning systems where several measures were implemented to achieve significant energy savings.

3. IMPLEMENTATION OF AN ENERGY MANAGEMENT SYSTEM

The following steps were taken to develop and implement an Energy Management System (EMS) at KSIA:

- Existing structures such as KPI's, environmental policies and procedures and sustainability reporting were analysed and expanded to include energy specific requirements.

[1]SA Grid kWh to CO2 Conversion Factor set at 0.957 as per the 'Journal of Energy in South Africa' – Vol 22 No 4; November 2011.

- Key members of management attended Energy Awareness Workshops and committed to supporting the initiative.
- Scope and Boundaries were identified
- Significant Energy Users were identified
- Key personnel were identified for inclusion in the Energy Management Team
- Potential energy Saving Opportunities were identified and quantified
- An Energy Policy was drafted by the Energy Team and approved by the Executive Committee
- The Energy Policy was signed by General Manager
- Action Plans and Targets were drawn up
- Energy savings interventions were implemented

4. IMPLEMENTATION CHALLENGES

- One of the biggest challenges experienced to implementing the PDCA was inadequate human resources in relation to the size of the site to ensure that all areas were included and implemented according to the scope and boundaries of the EnMS.
- The other challenge faced was the time required to undertake the tasks of the Plan Do Check Act and this was a result of inadequate human resources. The proposed solution is to officially distribute the responsibilities of the PDCA to the members of the KSIA Energy and Water Utilities Efficiency Team.

5. HIGHLIGHTS OF OPERATIONAL/ESO INTERVENTIONS

Various lighting and air conditioning system interventions were identified as potentially large energy saving opportunities. The lighting within the multi-storey parking lot was replaced with energy efficient lighting at a total capital cost of R 590 107.82. Through the benefit of the Eskom Standard Product Package, the Eskom rebate for the energy saving was R 229 466.95 and resulted in a nett investment of R 360 640.87.

The building maintenance system which was incorporated into the airports energy efficient building design was then optimised in order to control the lighting in various areas to suit operations. Through effective operational control of the BMS, a significant saving was made with no capital investment since the PLC control units and control software were already in place.

Timed controls were also introduced for the air conditioning plant, achieving significant energy savings with no capital investment, due to the use of existing control devices and software. The calculations did not take into account energy savings between 12am and 4am when it is assumed that the units would be switched off in the absence of BMS control.

The energy savings are detailed in Table 5.1 below.

5.1 Summary of All Interventions

System	Intervention	Capital Cost ZAR	Savings ZAR/annum	Payback Period Months	Energy Saving KWh/annum
Multi Storey Parkade (MSP) Lighting	Reduced lighting demand by replacing old lighting with lower wattage light sources	360 641	321 006	19.1	227 027
Internal and External Lighting of Various Areas	Programmed BMS control to reduce internal lighting by 35% and 65% to suit operational requirement and to switch off external lighting during the day	20 000	1 260 798	0.20	881 297
Air Conditioning	Programmed BMS control to switch off Air Conditioning to suit operations	20 000	1 179 445	0.19	824 432
		400 641	2 761 249		1 932 756

5.2 Details of Highlights

Details of the different ESO interventions:

Multi-storey Parking Lighting

- 748 x 130W fluorescent fittings were replaced with 58W fluorescent fittings
- 321 006kWh saved annually with 38.9% of the intervention cost covered by the Eskom rebate.

Internal and External Lighting

- The BMS system was programmed to control the operation of lights in various areas.
- 881 297KWh saved annually with no capital investment.

Air Conditioning

- The BMS system was programmed to control the air conditioning plant to suit operational requirements.
- 824 432kWh saved annually with no capital investment.

6. FUTURE PLANS

King Shaka International Airport plans to implement the following energy saving interventions in the short term:

- Installation of occupancy sensors for the control of lighting in the MSO building.
- Chilled water set-point control for air conditioning.
- Maximum demand control that limits the maximum amount of energy used by the plant and Carbon-dioxide sensors for the departure area of the terminal building to control the fresh air supply to that area.

- Installation of Variable Speed Drives (VSD's) to primary chilled water pumps on the Trane Chillers in the basement chiller plant room.

- Heat recovery and water recovery for the Terminal Building Air-Conditioning plant.

- All lighting technologies installed at the airport are being assessed towards implementation of the most recent energy saving technologies

King Shaka International Airport plans to perform feasibility studies in the following areas of energy efficiency improvements in the medium to long term:

- The use of solar energy for certain applications.

- The installation of a centralized air conditioning system for the Multi-Storey Offices

- The installation of heat pumps to replace current geysers

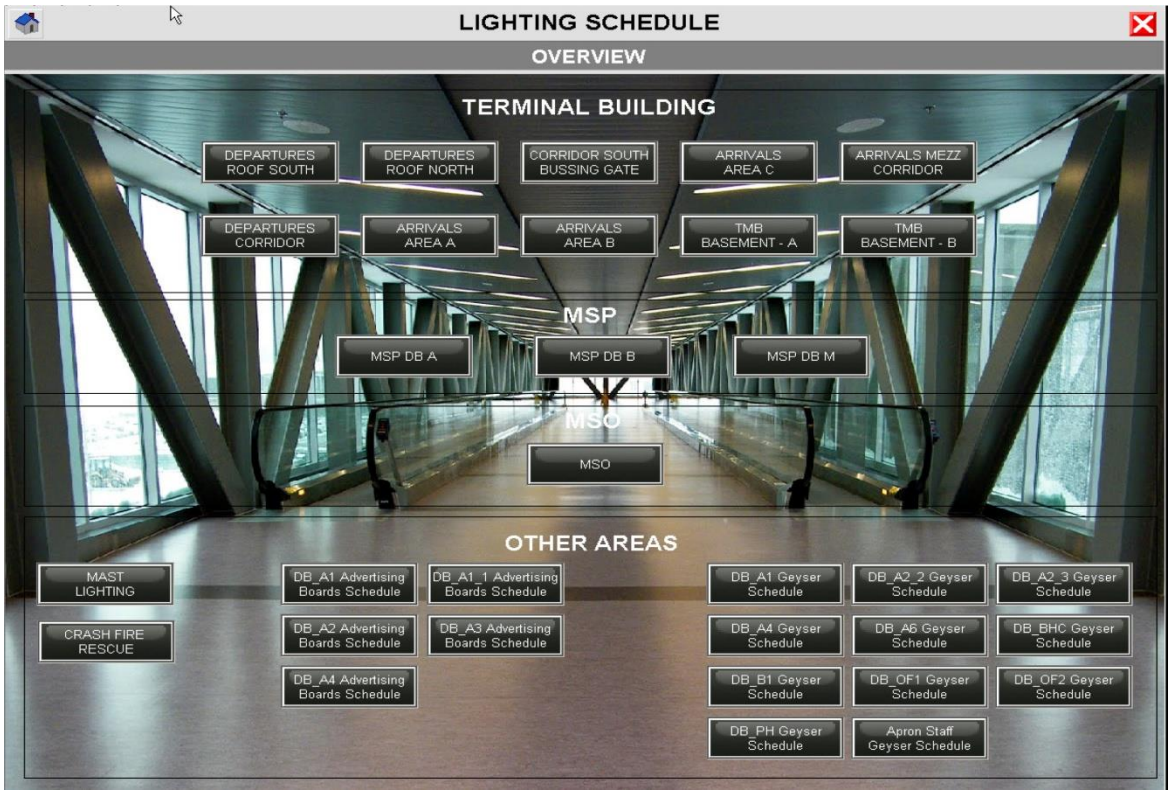
- The installation of occupancy sensors in the terminal building (enclosed areas)

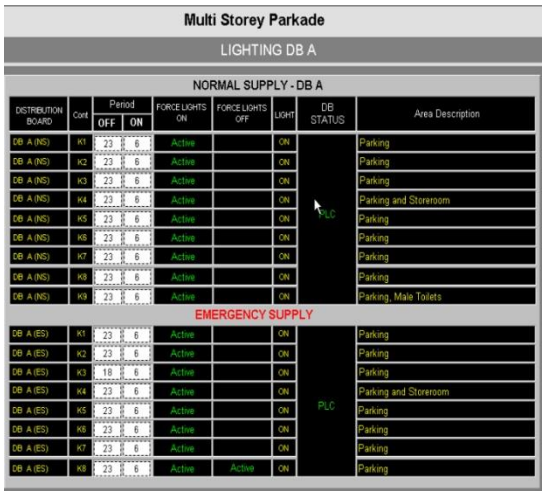
7. LESSONS LEARNED

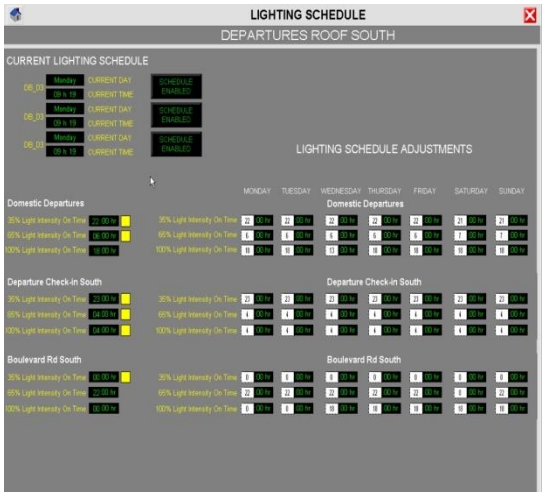
King Shaka International Airport has learned that significant energy savings may be realized without high capital investment and that optimizing existing equipment and operational control should be the first step to saving energy. The sustainable solution to achieve energy savings is only through the implementation of an Energy Management System as it will ensure that energy savings are achieved and maintained, irrespective of changes in technology, processes and personnel.

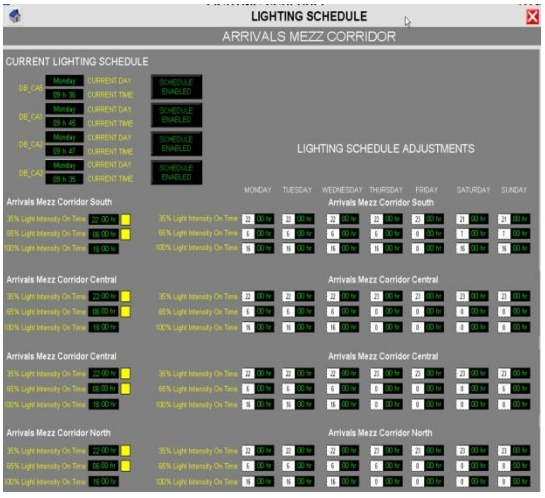
"Vision without action is a daydream. Action without vision is a nightmare". (Japanese Proverb)

ANNEXURE 1: BMS LIGHTING CONTROL SCREENS









ANNEXURE 2: BMS HVAC CONTROL SCREEN