Eskom Global Compact Case Study

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Abstract

Eskom is South Africa's major electricity supply utility. Power is primarily generated in a number of coal-fired power stations but also from additional sources such as nuclear, solar and, forthcoming, wind. Eskom, in a move to reduce electricity consumption during peak periods of demand, namely mornings and evenings, has initiated two broad programmes that seek to reduce the demand for power during these times. These initiatives, FLEXICON and COMRICON, are the responsibility of Demand Side Management at Eskom. This unit's mandate is to implement energy saving measures that benefit not only the end user, but the company as well. For example, by introducing the FLEXICON programme in Tableview, Western Cape, Eskom was able to offset the need for substantial network upgrades (cables and transformers) that were planned for implementation in 1999 or 2000. This implies that the end user was saved from a price hike, pay les for off-peak power and that resource consumption was reduced thereby impacting less on the environment.

FLEXICON is aimed at the consumer and targets that group's geysers. Simply put, Eskom, via a radio signal (the virtual power station), is able to switch their clients' geysers off during periods of peak power demand thereby reducing the demand for power at these peak times. Customers first have to agree to participate in the endeavour. There are several benefits for the end user: firstly, a reduced electricity bill is a key plus of this programme. Secondly, the end user can feel proud that they are participating in a programme that ultimately reduces negative environmental impacts and that save energy.

By selecting the FLEXICON programme, which works for the company, the community and the environment, to exemplify their participation in the Global Compact, Eskom demonstrate the integration of principles 8 and 9 (Environment) of the Global Compact into their operation.

Eskom Global Compact Case Study – Flexible Hot Water Load Management Control System

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Introduction

Eskom, as a signatory to the United Nations Global Compact, has undertaken to integrate the 9 Global Compact principles into their operation. To showcase this integration, Eskom has opted to use its FLEXICON – **Flexi**ble Hot Water Load Management **Con**trol – system as testimony to the company's incorporation of principles 8 and 9 of the Global Compact which relate to the environment. These principles are:

- **Principle 8**: [Businesses should] undertake initiatives to promote greater environmental responsibility; and
- **Principle 9**: [Businesses should] encourage the development and diffusion of environmentally friendly technologies.

The FLEXICON system forms part of Eskom's Demand Side Management (DSM) programme, an initiative coordinated by the DSM Department at Eskom's headquarters in Johannesburg. The main objective of the DSM Department is to find ways of reducing the demand for power during peak periods of electricity consumption. FLEXICON is really an ingenious way for Eskom to reduce geyser energy consumption during peak periods. With the consent of the participating households, who also benefit, Eskom are able to show energy savings during these periods. These savings have numerous benefits expanded upon later in this document.

Eskom's environmental policy binds the company to:

- promote open communication on environmental issues amongst employees and stakeholders;
- establish an environmental management system with a view to ensuring continual improvement in appropriate business activities, including prevention of pollution where economically viable and sustainable;
- contribute toward sustainable development through the efficient production, distribution and use of energy; and
- educate, train and motivate its employees about the environment.

Points 3 and 4 from the policy are relevant to the FLEXICON case study. The compilation of this case study was facilitated by a series of interviews with the relevant personnel at Eskom, namely the responsible environmental advisor and the manager of the Demand Side Management department who is ultimately responsible for the FLEXICON case study. Additional contact with limited external stakeholders took place during the researching of the

case study, as well as anecdotal accounts from Eskom and video footage of stakeholder engagement.

About Eskom

Over the last century Eskom[1] has established itself as a leading electricity supply company, providing over 95% of South Africa's electricity needs and over 50% of Africa's. The ownership of Eskom vests in the South African government. Eskom is among the top seven utilities in the world in terms of generation capacity, and among the top nine in terms of sales. Eskom generates, transmits, distributes and sells power to industrial, mining, commercial, agricultural and residential customers and redistributors.

In 1999 Eskom embarked on a new strategic trajectory with the aim of becoming the pre-eminent African energy and related services business. Eskom has set out to leverage its core competencies as products and services into new markets, focussing on the African market, but with aspirations to penetrate other markets, both emerging and developed. This new strategy implies that:

- Eskom is proud of being African;
- Eskom functions as a global business;
- Eskom promotes economic growth in South Africa and Africa, through active contributions to the New Partnership for Africa's Development (NEPAD);
- Eskom has ventured into energy related products and services;
- Eskom has formed joint venture partnerships to augment skills and open up new markets; and
- Eskom will be chosen as a preferred developmental partner.

The implementation of this new paradigm rests on four key strategies, namely:

- Advancing Eskom's role as the leading electricity supplier in Africa;
- Expanding Eskom's business aspirations through energy and related services;
- Expanding Eskom's business reach through e-business;
- Partnering South Africa into Africa.

[1] www.eskom.co.za

This diversification strategy is largely implemented through Eskom Enterprises (Pty) Ltd., Eskom's vehicle through which non-regulated activities are undertaken and which has, over the last two years, created a major business foundation for the development of Africa's energy and telecommunications infrastructure.

Eskom has an environmental management system that supports continual improvement in the ways in which the organisation manages its impacts on the wider environment. The organisation promotes open communication about environmental issues and aims to educate, train and motivate its employees about environmental matters.

Demand Side Management

Background

In order to understand the reason behind selecting FLEXICON as the major focus of this case study, it is important to understand the context within which the programme was initiated.

Basically, the more energy that is used, the more energy needs to be generated. The result being that more power stations need to be built which inevitably results in the consumer having to bear the cost on the one hand and the environment on the other. By using energy wisely, the consumer helps to keep costs down and avoids negative environmental impacts that would have arisen with the construction of additional supply stations.

Additionally, South Africa's coal reserves are not infinite. The country's growing population rate and accompanying demands on its energy resources have a severe impact on the country's natural resources. Hence, the less coal consumed implies that there will be more of this cheap and valuable resource to maintain the country's energy supply for substantially longer. Therefore, the environment benefits from the efficient use of energy. For example, every kilowatt-hour of electricity saved means one less kilogram of carbon dioxide generated by the power station and released into the atmosphere.

Details

Eskom established the Demand Side Management (DSM) department to deal with a range of issues, but all geared towards reducing peak electricity consumption.

When a utility or local authority that supplies electricity influences the way it is used by customers, this activity is known as Demand Side Management. DSM consists out of two focus areas: the commercial sector and the industrial sector. For the case study under review, the main focus is on the commercial sector, and within that the emphasis is given to households as customers rather than companies.

The term Demand Side Management was first used in the United States in the early 1980s to describe the planning and implementation of utility activities designed to influence the time, pattern and/or amount of electricity demand in ways that would increase customer satisfaction, and simultaneously produce desired changes in the utility's load-shape[2]. DSM is an alternative to power system expansion and is also a tangible means of providing customers with a valuable service. DSM initiatives have also been adopted in the United Kingdom, Europe, Australia and elsewhere.

DSM is still a relatively new concept to South Africa. The South African government, in the White Paper on Energy Policy, recognises the importance of energy efficiency, and commits itself to promoting the efficient use of energy in all demand sectors. It also commits itself to investigating the establishment of 'appropriate institutional infrastructure and capacity for the implementation of energy efficiency strategies'. Although Eskom formally recognised DSM as far back as 1992, the first DSM plan was only produced in 1994. In this plan, the role of DSM was established and a wide range of DSM opportunities and alternatives available to Eskom were identified. Although some municipalities and local service providers have power systems (ripple control) which could be classified as DSM type interventions, these do not have the assed benefit of producing customer satisfaction.

South Africa’s growing population places demands on its energy resources which in turn has a severe impact on the country's natural resources. More people have access to electricity and most residential houses utilise electricity at peak times. This places a strain on Eskom's resources requiring the company to generate more energy. The result is additional power stations are required inevitably resulting in the consumer having to bear the financial costs and the environment bearing the hidden costs.

By using energy wisely, South African consumers can help to keep costs down and reduce their environmental impacts both by obviating the need to construct additional power stations and by utilising energy more efficiently. This reduces the amount of water[3] required to generate the power, reduces the amount of emissions released into the air, and so on.

The benefits of DSM are:

- A DSM programme can be implemented within 12 months while it can take up to 10 years to build a new power station;

[2] The graphic that illustrates how much and when electricity is consumed.
[3] Water is used for two purposes in electricity generation – driving turbines to generate power and for cooling.

- It is far more cost-effective to implement a Demand Side Management programme than to build a new power station;
- The customer benefits financially due to the range of energy-efficient available, since the value of the electricity service to customers is improved;
- Without demand-side management, the South African electricity demand could double over the next 20 years requiring extra generation capacity. This will result in significant electricity price increases;
- Customers can be better served by having a choice of options that enhance the benefits received from electricity while maintaining the same or lower costs;
- Commercial entities benefit through savings on monthly electricity accounts, while electricity supply companies benefit by implementing and maintaining the project, as well as through shared savings;
- The environment benefits from the efficient use of energy. For example, every kilowatt-hour of electricity saved means one less kilogram of carbon dioxide generated by the power station and released into the atmosphere and the preservation of significant volumes of scarce water resources for other uses. This is in line with the South African government's White Paper on Energy Policy (1998), which places a high premium on the environment, affordable energy to all and energy efficiency.

Tableview Case Study

Background

The workings of the FLEXICON system are illustrated by the following example from Tableview residential area near Cape Town.

Conventional hot water load[4] management systems have traditionally focused on effectively managing load during peak periods with little or no regard for customer comfort or centralised scheduling. The objective of the Tableview project was to maximise the amount of shiftable load[5] during the peak periods whilst ensuring that customers seldom or never experience the unpleasant fate of a cold shower or bath. One of the underlying principles of the FLEXICON system is that of individual choice, particularly in how their geyser is controlled.

[4] The amount of power used at a particular time during the day
[5] How much power can be saved during peak times and redistributed, or shifted, to off peak periods

This is made possible by the individual addressability of each load switch with this particular system via a radio signal.

Implementation

The decision was taken to implement this large-scale pilot project in the Tableview area, near Cape Town, Western Province, due to sustained, unprecedented and continuing demand for electricity. Substantial network upgrades in the form of cables and transformers were planned for the Tableview area with implementation due to start in 1999. Information obtained indicated that there were approximately 9000 households in the area with an average of 1.25 geysers per household.

One of the major benefits of implementing a load management system in the area was that most of the planned network upgrades would be deferred by a few years. Additionally, the Tableview DSM pilot served as a yardstick for the rollout of a national DSM initiative. Load shifting from the morning and evening peaks to off-peak periods would improve the load factor and reduce the magnitude of the demand peaks. The end result: a more efficient utilisation of the existing electricity reticulation infrastructure. At the outset, it was hoped that the 1998 winter evening peak of 33 MW[6] would be reduced by 10MW, to around 23MW, almost a 30% reduction. The implementation of the Tableview load management system commenced during the latter half of 1998 and continued through 1999. The system involved the installation of 9800 geyser load switches in total as well as a number of other infrastructure requirements.

Once the 9800 load switches were installed in the Tableview area, a series of tests was then run. The information gleaned from the testing was used to determine the amount of load that could be shifted from peak to off-peak periods and the amount of demand reduction achievable. Test results showed that the morning water heating peak occurred at 07h30 and was 8.2 MW in magnitude whilst evening water heating peaked at 21h00 and was 6.4 MW in magnitude. This translates to a diversified figure of 1.02 kW[7] per geyser in the morning and 0.8 kW in the evening. This represents the maximum amount of load that can be removed from the load profile at each time interval.

Since the testing of the load management system in Tableview there has been a tremendous amount of growth in electricity demand. During the 2001 winter, tests were conducted using the load management system with the existing 9000-odd relays installed to determine the

[6] Megawatt
[7] Kilowatt

amount of manageable load. The Tableview area has expanded to such an extent that in excess of 6000 new households have been built in the area since the initial installations were completed. The acquisition of this new portion of the water-heating load will take place when the Tableview load management system expansion of 6000 relays takes place during the latter part of 2001, to be completed within the first quarter of 2002.

Features

The benefits to distribution of this manageable load will be the capacity to optimise their bulk purchase costs for the region whilst deferring network (specifically cable) upgrades for a number of years depending upon the continued rate of growth in the area.

The main feature of the hot water load control system is its *flexibility*. One of the underlying principles of the system is that of individual customer choice, particularly in how the geyser is controlled. The load management system implemented allows each geyser relay to be addressed individually. This means that it is possible to customise the manner in which each customer's geyser is controlled to cater for the household's lifestyle.

Initially, a number of preset control algorithms, or geyser control options, were established. These permitted Eskom a greater or lesser degree of control of the customer's geyser. During the commissioning of the project households were allocated a control option based on a short questionnaire filled in during installation of the load switch. The information recorded at the time of installation included the geyser temperature, element size, number of people in the household and times at which baths or showers are taken.

The customer is given the choice of changing from their default algorithm to one of a higher or lesser degree of control by contacting a 24-hr phone-in centre.

Benefits

The introduction of the FLEXICON system in Tableview has had many positive spin-offs for the customer and for Eskom. Customer benefits include:

- lower than expected annual increases in electricity prices;
- a better quality of supply (less power interruptions) due to less stress on the local reticulation network;
- management of geyser load out of peak periods; and

- a reduction in loss of power from geysers by way of an "efficiency" switching algorithm that keeps the geyser off during the evening and midday periods to varying degrees as per customer request.

Eskom benefits include:

- Improvement in the national electricity supply load factor;
- Conservation of natural resources; and
- Lower pollution levels whilst still providing the same quality of service to the customer.

Case Study Analysis

Determining how successfully DSM and FLEXICON have been integrated into Eskom, from a global compact perspective, is the purpose of this section. This will be assessed using the Global Compact Performance Model and referring to the three applicable Global Compact principles. These principles, once again, are:

- **Principle 8**: [Businesses should] undertake initiatives to promote greater environmental responsibility; and
- **Principle 9**: [Businesses should] encourage the development and diffusion of environmentally friendly technologies.

The integration and internalisation of these principles into Eskom, into its operating systems, is assessed by analysing the case study using the Global Compact Performance Model. The model is comprised of ten elements, listed below with a selected comment:

- Vision – a shared ambition to a achieve a highly desirable future;
- Leadership – driving the vision through the organisation;
- Empowerment – releasing the full potential of people in line with the vision;
- Resources – managing the means to implement the strategy and empower employees;
- Policies & strategy – where an organisation spells out its culture and specific ambitions;
- Processes & innovation – thrives in organisations that foster systems thinking;
- Impact on people – commitment to principles beyond profit impacts positively on people;
- Impact on the value chain – cooperation and transaction provides added value;

- Impact on society – the perception of company performance by society;
- Reporting – progress against objectives add a social and environmental ledger to financial results.

The energy sector is an important player in the South African economy, contributing 15% per annum to the Gross Domestic Product (GDP) and employing over 250 000 people. Electricity is a key factor in South Africa's prospects for economic growth, the development of communities' capabilities and the improvement of the quality of life of all South Africans. To this end, Eskom developed the DSM programme to plan and implement activities designed to influence the time, pattern and amount of electricity usage, in order to reduce the consumption of electricity during peak times. This goal has been achieved through deliberate interventions, such as in Tableview, in the form of electricity efficiency and load management programmes, in the residential, commercial and industrial sectors. Eskom's recognition that social and economic development is enhanced with the supply of cheap and efficient electricity lead them to introduce the DSM programme in the early nineties. Seemingly paradoxical, the fact that DSM actually reduces the amount of energy consumed, this is easily explained as follows: Eskom's DSM incentives allow the end user to benefit from the supply of cheap power whilst simultaneously facilitating the redistribution of power to other key sectors for their use in activities which are central to the country's economy.

To realise DSM meant that Eskom had to form a department with the necessary skills to implement the energy savings. DSM is an important component of Eskom with its own complement of staff. They explore numerous avenues for energy savings and also fulfil an educational role by explaining to customers the benefits of demand side management initiatives and various other energy saving measures. The latter include the many innovations that Eskom have either developed or endorse such as energy saving light bulbs, geyser blankets and water pipe insulation. All these measures, be they small but effective innovations or large scale efforts such as FLEXICON, have broader impacts on society and people.

End Comments

It is Eskom's goal to achieve the following objectives through its DSM programme:

- To add value to Eskom's bottom line by initiating DSM programmes that comply with sound business principles;

- To concentrate on DSM programmes that provide win-win situations for the customer and for Eskom;
- To create the opportunity for Eskom to improve supply-side planning, which results in lowered risks in implementing supply-side solutions;
- To achieve market transformation and ensure DSM sustainability. This should ensure that the market does not regress to lower levels of efficiency after active participation of the utility has ceased;
- To reduce the maximum demand by changing the configuration or magnitude of the load shape. Eskom will thus be able to accommodate the system demand growth using existing capacity. This flexibility means that, in the event of market transformation or market deregulation, Eskom will be competitive in the market and remain one of the cheapest energy suppliers in the world, thus creating value for customers.

Via a DSM, Eskom could potentially, if DSM is fully expanded, see the following results:

- R2,5 billion (1997 rand) savings by customers due to less kilowatt-hours of electricity consumed over the next 20 years;
- Reducing peak demand by 4 000 megawatts by the year 2015. This is more than the generation capacity of Eskom's largest power station, Kendal and means that one less power station, costing in excess of R10 billion, will need to be constructed;
- Energy savings of more than 350 gigawatt-hours over 20 years due to increased efficiency. This is more than twice the electricity generated by Eskom in 1995;
- 185 million tons of coal not burned over 20 years. This is more than 2.5 times the amount of coal exported by South Africa in 1995;
- 490 billion litres of water saved by power stations over 20 years – equivalent to 20% of the Vaal Dam's[8] capacity; and
- 118 million tons of greenhouse gases not emitted into the atmosphere –equivalent to 2% of greenhouse gas emissions from the burning of fossil fuels in 1990.

Eskom has an environmental management system that supports continual improvement in the ways in which the organisation manages its impacts on the wider environment. The organisation promotes open communication about environmental issues and aims to

[8] One of South Africa's largest water impoundments

educate, train and motivate its employees about environmental matters. The company's environmental objectives fit nicely with the environmental savings that DSM affords.

With electricity consumption growth in the residential sector expected to be over 15% p.a. over the next ten years, the implications for Eskom, the supplier are profound. New plants would need to be constructed to meet this new load type i.e. generation plant capable of running for relatively short periods during the day and only for a few months of the year. The capacity utilisation of this new plant would thus be extremely low compared with the currently installed capacity.

In considering the cost implications of new generation capacity provision to the country and its electricity consumers, DSM becomes an extremely attractive alternative. Although South Africa currently has surplus generation capacity, the lead times for new plant construction are lengthy (up to 10 years).

If DSM can be used to limit residential demand growth or mitigate the impacts through the provision of incentives for industrial, commercial and residential users to move load out of the peak periods, substantial benefits for all customer groups could be derived. Inevitably, high price increases would be avoided through the deferment and probable avoidance of the construction of new generation facilities.

The potential therefore exists to substantially defer any supply side generation construction decision through DSM until well into the next millennium. With the expansion of DSM, construction of certain new plants could well be avoided.