Developing an integrated Demand Management process for ensuring future electricity supply

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ABSTRACT

South Africa (SA) faces an electricity shortage in the next three to five years due to the demand for electricity exceeding supply. But that does not mean industry needs to grind to a halt. Rather it demands a concerted and coordinated effort to ensure that the electricity resources, which are available, are used with optimum efficiency and minimal waste, even as Eskom invests in bringing new generation capacity online.

Electricity constraints are far from a uniquely South African phenomenon; rather, they are a reality faced by countries in the developed and the developing world. As a global reality, this gives Eskom and every South African, the opportunity to share in solutions to the issue. There is a vested interest for everyone to use less electricity wherever possible. That interest lies in reducing the cost of living or doing business in reducing the impact on the environment and in ensuring demand doesn't exceed supply.

In response to the energy challenges facing South Africa, Eskom has established an Integrated Demand Management (IDM) Division. IDM is dedicated to ensuring security of electricity supply through coordinating and consolidating the various initiatives aimed at optimising electricity use and balancing electricity supply and demand. A key aspect of this programme is the promotion and implementation of more energy-efficient technologies, processes and behaviours amongst all consumers.

Through IDM, all of Eskom's demand management initiatives are brought together in a single programme. In the past there was a degree of confusion for customers when it came to promoting demand management initiatives; this was due to various departments within Eskom selling demand management solutions in isolation from each other. As a result, these were neither synchronised nor optimised. The result was confusing and difficult for customers to engage meaningfully with Eskom's demand reduction initiatives.

The IDM objective is to ensure single ownership of Demand Side Management (DSM) strategies, objectives and operations throughout Eskom. It takes a market-driven approach to understand and meet consumer requirements and provides a platform from which Eskom can collaborate with government, external stakeholders and consumers.

Since inception at the end of the 2012 financial year, the DSM programme in South Africa has realised a verified demand power saving of 3076 Megawatts (MW). This was achieved as a result of the various technologies implemented, ranging from Compact Fluorescent Lights (CFL's) to optimisation of processes at deep underground mines. The saving achieved to date is mainly due to the initiatives in the residential sector contributing 2333 MW.

Concerns were therefore raised regarding the slow uptake of electrical energy savings in the Commercial and Industrial (C&I) sectors. One of the biggest problems cited for poor performance in these sectors is the onerous Energy Services Company (ESCO) funding approval process for Energy Efficiency Demand Side Management (EEDSM).

Energy Services Companies (ESCOs) face major problems in obtaining approval for EEDSM projects via the ESCO model funding process. Some of these problems are: the evaluation process being too lengthy and too technical; project proposals being rejected as the evaluation process is not well understood; the need for various reviews by separate technical, financial, and procurement committees; Eskom did not negotiate contracts in a simple, efficient manner. In view of these problems, there was an urgent need for an improved process.

This dissertation covers the development of a new IDM process called the Standard Offer (SO) for Project Developers (PDs) participating in the Commercial and Industrial (C&I) sector of South Africa. The study will develop a process to simplify the ESCO funding model for better market uptake on energy efficiency projects.

The benefits of implementing this approach will streamline the process of evaluating project proposals, reducing the burden on Eskom staff and facilitating a larger pipeline of energy efficiency projects.

The new SO process was implemented and tested on a large retail store in South Africa. Each step was evaluated against the requirements of the new process and compared against the present ESCO process.

It was proven through implementation, the new SO process is successful in increasing market uptake for EEDSM, improving approval turnaround times and reducing the burden on Eskom staff.

PREFACE AND ACKNOWLEDGEMENTS

"I believe I can do all things through Christ who strengthens me"

-Philippians 4:13-

It is my aspiration that this dissertation encourages the increased uptake of energy efficiency in South Africa and the rest of Africa. Whosoever wishes to increase their knowledge, continue research in the topic or implement the strategies, I wish you the best of success.

I would firstly like to thank God for blessing me with this opportunity to do my masters, and for granting me the wisdom, knowledge and grace to complete my dissertation.

I thank my wife Maria, and my children Justin and Nicholas who have encouraged me and given me the space I needed to complete my dissertation. Your support has made me believe I can achieve anything I put my mind and heart into for the benefit of my family.

Thank you to my parents who never stopped believing in my ability to succeed.

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Thank you to my project team at Eskom for being committed and passionate in developing the new process.

-Thank you-

TABLE OF CONTENTS

TABLE OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

ASP	Aggregated Standard Product
BBBEE	Broad Based Black Economic Empowerment
BRA	Benefits Realisation Approval
C&I	Commercial and Industrial
CFL	Compact Fluorescent Lamp
CIC	Capital Investment Committee
CIDB	Compliance Industry Development Board
CO_2	Carbon Dioxide
COC	Certificate of Completion
CRA	Concept Release Approval
DOE	Department of Energy
DPE	Department of Public Enterprise
DR	Demand Response
DRA	Definition Release Approval
DSM	Demand Side Management
DTI	Department of Trade and Industry
E REV	Energy Revolution
ECS	Energy Conservation Scheme
EE	Energy Efficiency
EEDSM	Energy Efficiency Demand Side Management
ERA	Execution Release Approval
ESCO	Energy Services Company
FRA	Finalisation Release Approval
FY	Financial Year
HVAC	Heating, Ventilation and Air Conditioning
IDM	Integrated Demand Management
IEC	International Electrotechnical Commission
LF	Load factor
LM	Load Management
LOA	Letter of Authority
LOI	Letter of Intent
LPU	Large Power users
M&V	Measurement and Verification
MAD	Measure Acceptance Date
MAP	Measure Acceptance Period
MD	Maximum Demand
MYPD	Multi – Year Price Determination (tariff application)
NEC	New Engineering Contract
NERSA	National Energy Regulator of South Africa

OHSACT	Occupational Health and Safety Act
PA	Performance Assessment
PBB	Power Buy Back
PC	Performance Contracting
PCP	Power Conservation Programme
PD	Project Developer
PEC	Project Evaluation Committee
PLCM	Project Life Cycle Model
PM	Project Manager (employed by IDM)
PMO	Programme Management Office
PR	Public Relations
PTC	Procurement Tender Committee
RACI	Responsible, Accountable, Consulted, Informed
RMR	Residential Mass Rollout
SA	South Africa
SANS	South African National Standards
SD&L	Supplier Development and Localisation
SHE	Safety Health and Environmental
SO	Standard Offer
SOP	Standard Offer Programme
SOW	Scope of Work
SP	Standard Product
STA	Systems Thinking Approach
SWH	Solar Water Heating
TEC	Technical Evaluation Committee
TOU	Time of Use
US	United States

Chapter 1

1. INTRODUCTION

1.1. BACKGROUND: ELECTRICAL ENERGY SITUATION

Throughout the last decade, the global arena has demonstrated that the electricity supply value chain is at a crossroad. Current global electricity supply and demand trends are unsustainable from an economic, environmental and social perspective. The sustainability of these elements requires a shift in the traditional methodology of ensuring power system security and adequacy. Recently, matching power supply and demand has largely consisted of increasing supply side capacity, based on demand growth trajectories. This philosophy has seen major investment initiatives in power utility infrastructure.

To this end, a transition has already commenced in the form of introducing demand response and energy efficiency programs into the supply demand mix. Demand response and energy efficiency look at managing demand and energy usage from the end user perspective. Demand response and energy efficiency programs are fast providing customers new options for managing their energy costs along with providing power utilities new options that steer towards reliable supply at reduced costs. Demand response and energy efficiency programs are showing positive advancement towards improved system reliability, cost avoidance of new power plants, energy usage reduction, improved system efficiency, improved risk management, positive environmental impacts and improved customer service.

Current adverse power system events due to operating close to safety margins, is resulting in the development and practice of demand response around the globe; South Africa is no exception. Governments and utility regulators are increasing support for the implementation of demand response and energy efficiency programs into the supply demand balance.

The benefits of embracing demand response and energy efficiency programs in terms of reduced energy costs; economic, political and environmental sustainability is evolving the mind-sets of consumers and utilities alike. Such holistic thinking of these benefits is evidence that utilities are venturing towards a systems thinking perspective rather than purely technocratic approaches to ensuring power system security and adequacy (1).

1.2. GLOBAL TREND DRIVING FORCES

Currently, the greatest motivation for energy efficiency can be attributed to global concerns for escalating costs related to energy usage worldwide. Through energy efficiency, countries are able to successfully minimise greenhouse gas emissions and simultaneously prolong energy supplies in a manner that is cost, time and environmentally effective. Developed countries have long been market leaders in energy efficiency. However, despite obstacles that continue to challenge developing and transitional countries, they are fast expanding their own markets for energy efficiency with consumer goods and services becoming more widely available. Energy efficiency improves energy security and system reliability and thereby reduces the potential for disruptions from brownouts or blackouts (2).

In 2011, the total investment in energy efficiency globally was similar in magnitude to supply-side investment in renewable or fossil fuel electricity generation (Figure 1-1). Although this is a step in the right direction, EE is still two-thirds less than fossil fuel subsidies. This investment is unevenly spread across countries and market sectors namely; industrial, commercial, and residential (3).

Countries worldwide are attempting to become more proactive in their responses to climate change and the risks surrounding it. This may be regarded as another driving force behind global energy efficiency. Since 1950, measured Carbon emissions have shown industrialised countries are responsible for 74% of emissions, while developing countries contribute 26% of emissions. These statistics have since changed drastically with emissions of developed countries having now reduced to 60% and projected emissions of developing countries seen to outgrow developed countries from as early as 2020, if no steps are taken to prevent this (4).

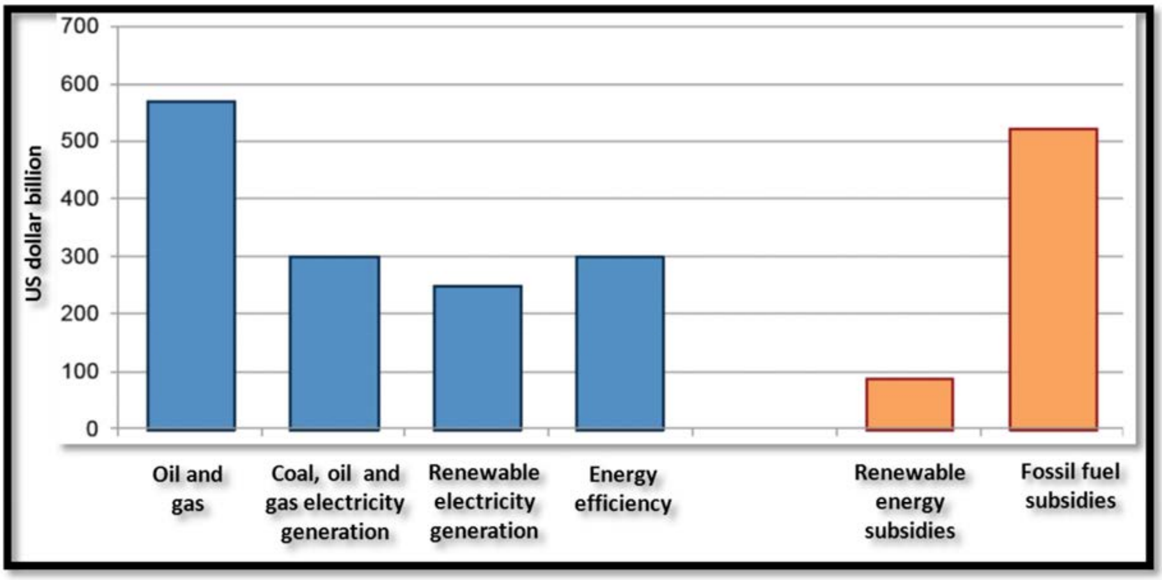


Figure 1-1: Global levels of investment, 2011 (3)

Figure 1-2 illustrates the forecast increase in primary energy consumption in the world. In the reference (Ref) bar, the base case scenario, the demand for energy over the next 40 years, will increase by over 63%, with fossil fuels growing over 87%. Carbon emissions will double by 2050, making the reference case scenario unsustainable. In the Energy Revolution (E Rev) scenario, fossil fuel usage decreases by 45%, with annual per capita greenhouse emissions dropping from 3.8 tonnes/capita, to 1.2 tonnes/capita. Although the focus on renewable energy grows almost 340% in the energy revolution scenario, it is insufficient to supply the world's demand for energy; hence energy efficiency and Demand Side Management will play a pivotal role in future scenario (5).

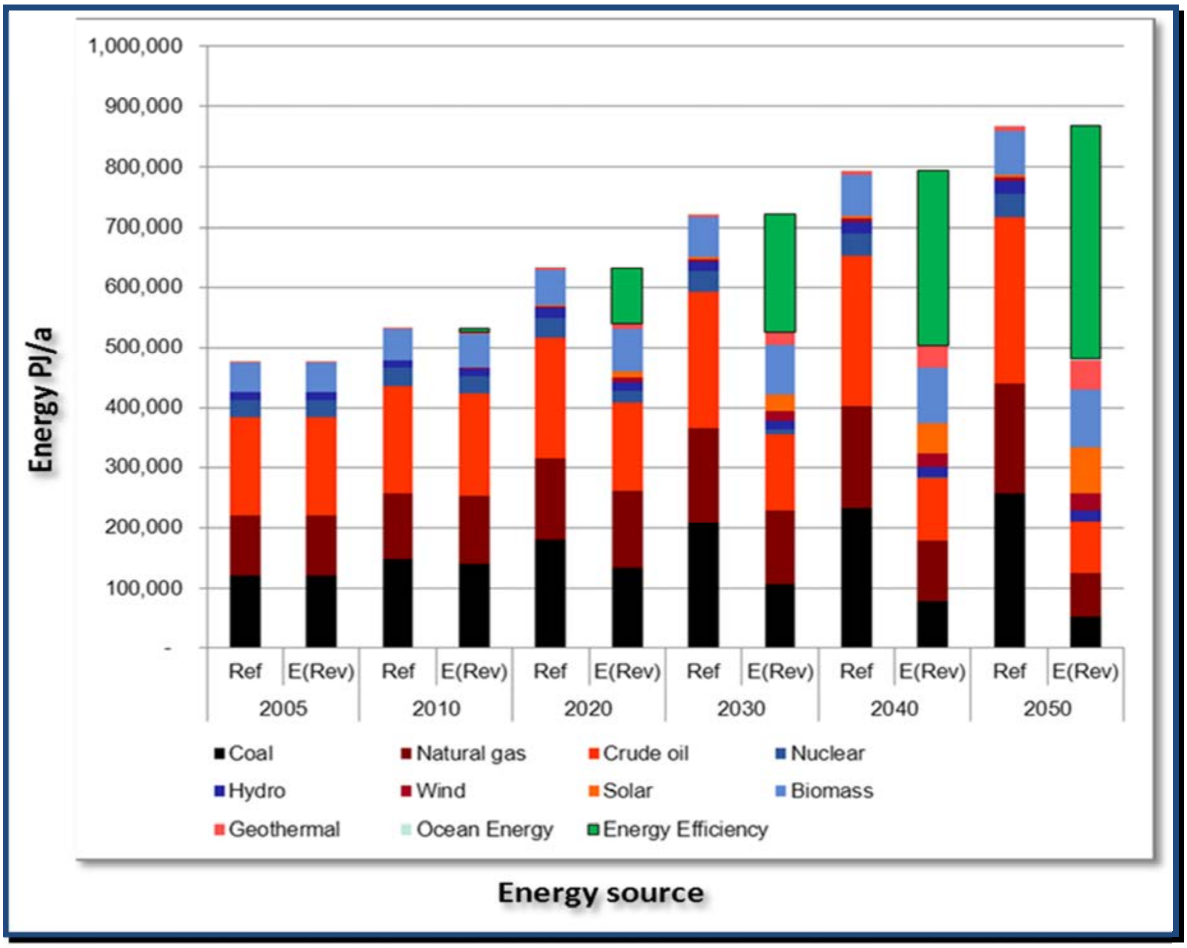


Figure 1-2: Development of primary energy consumption, Energy revolution scenarios (5)

1.3. SOUTH AFRICAN ELECTRICITY SITUATION

Eskom is South Africa's main electricity supplier, generating approximately 95% of the electricity used in South Africa and more than 40% of the electricity used in Africa. The company generates, transmits and distributes electricity to 4.9 million customers in the industrial, mining, commercial, agricultural and residential sectors. Eskom has a maximum self-generated capacity of 41 647 MW. Eskom's net capacity shown in Figure 1-3 indicates that 85% of power produced by Eskom is from coal supplied power stations (6).

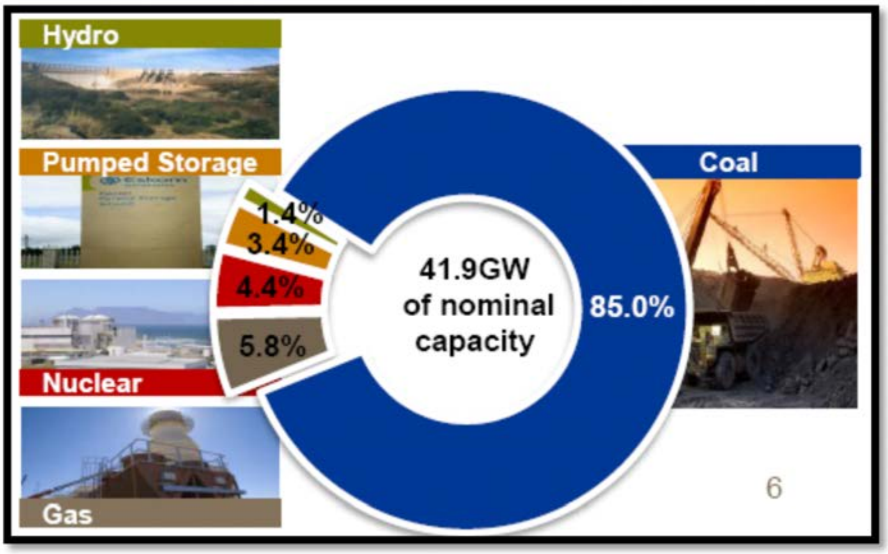


Figure 1-3: Eskom's net energy capacity mix (6)

Due to the growth in demand in South Africa, coupled with ageing power stations and the shortage of supply, Eskom plans to add additional capacity of 11 126 MW to the electricity grid by 2019 (Figure 1-4) (6).

Project	Planned						Total
	Year to 31 Mar 2014	Year to 31 Mar 2015	Year to 31 Mar 2016	Year to 31 Mar 2017	Year to 31 Mar 2018	Year to 31 Mar 2019	
Grootvlei (return to service)	30						**30**
Komati (return to service)	100						**100**
Medupi (coal fired)		1 588	1 588	1 588			**4 764**
Kusile (coal fired)		800	800	800	1 600	800	**4 800**
Ingula (pumped storage)		1 332					**1 332**
Sere wind farm (renewable)		100					**100**
Total (MW)	**130**	**3 820**	**2 388**	**2 388**	**1 600**	**800**	**11 126**

Figure 1-4: Planned capacity expansion projects (6)

1.4. STATE OF THE ELECTRICITY SYSTEM – THE NEED FOR ENERGY MANAGEMENT

The South African electrical power system is constraint. Most of the power stations are in mid-life and require increased maintenance (Figure 1-5), but maintenance has constantly been shifted in order to ensure demand in South Africa is met. The current strategy of shifting maintenance can no longer be sustained (6).

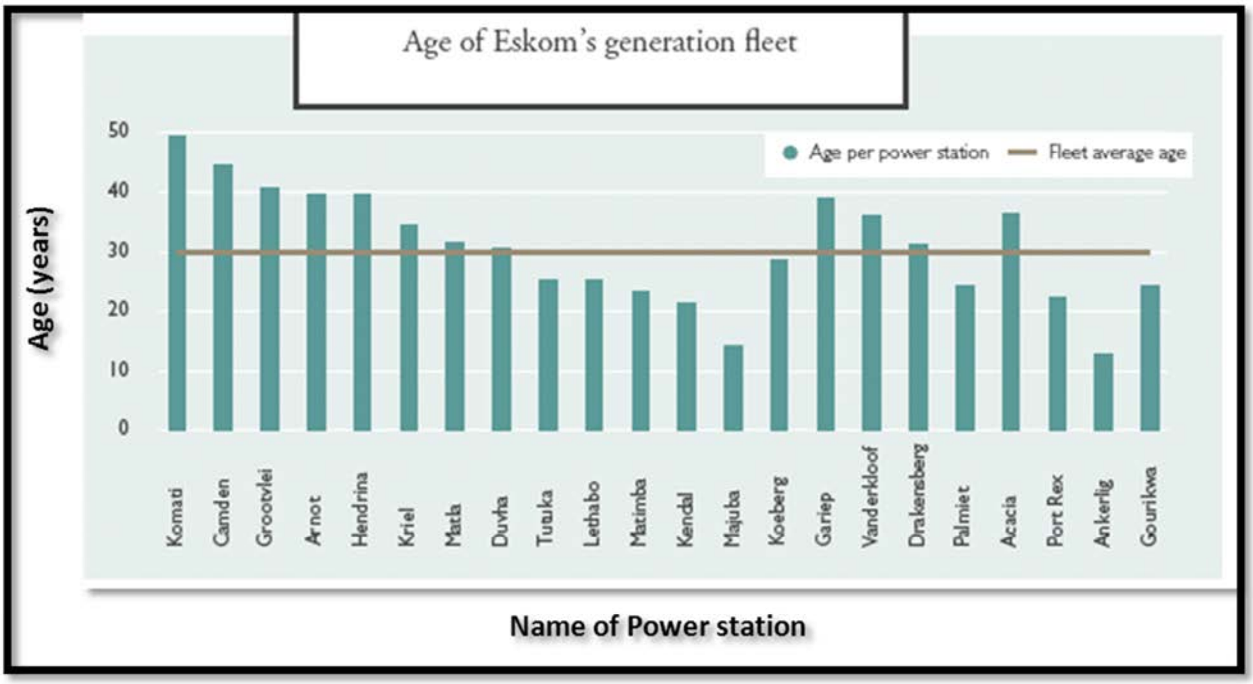


Figure 1-5: Age of Eskom's generation fleet (6)

Since 2008, Eskom has maintained a stable power supply, but balancing supply and demand has been a national challenge. Eskom is doing significant maintenance to address backlogs, while at the same time meeting demand. The Supply side is also constrained due to the unreliability of some of the power stations and power imports. Figure 1-6 illustrates the forecasted gap between supply and demand. Year 2012 shows an electricity gap of 9 TWh, which is the equivalent of about 1000 MW base load capacity. 1 TWh is approximately equivalent to the annual energy consumption of 200 000 households in South Africa (7).

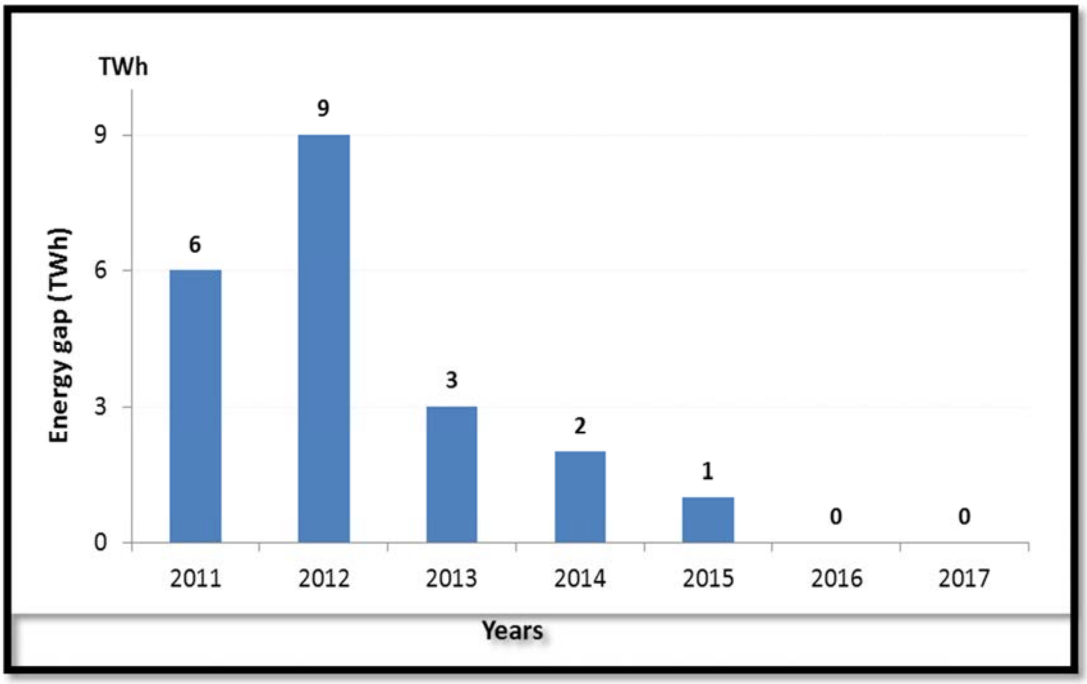


Figure 1-6: Annual electricity supply gap forecast (7)

With the supply/demand imbalance continuing to grow, there is a very real risk the gap between supply and demand will reach a point of no recovery for Eskom. A method of closing this gap would be to continuously increase supply at the same rate of demand growth, which is neither feasible nor economical. The time and cost constraints of attempting to expand supply to meet demand cannot be depicted as a practical solution, therefore, more realistic goals can be met by addressing demand management.

Figure 1-7 illustrates South Africa's summer and winter load profiles. It can be seen that in winter, the demand for electricity is much higher than in summer, for a shorter period of time. The demand forecast for winter in 2012 was just under 37 000 MW, this means that the electrical system would be tight if a higher system peak was experienced. A colder than expected winter puts added pressure on the system, for every 1 degree centigrade decrease in winter temperature, electricity demand will increase by 600-700MW during the evening peak (8).

The summer load profile is much flatter, peaking around 33 000 MW; therefore if there is a system constraint, the system will remain constrained for the entire day. Most power station planned maintenance is done in summer when demand is lower, so that maximum capacity is available to meet demand in winter. A warmer than expected summer could also be a problem, as it increases air conditioning load and demand can increase by up to 400 MW (8).

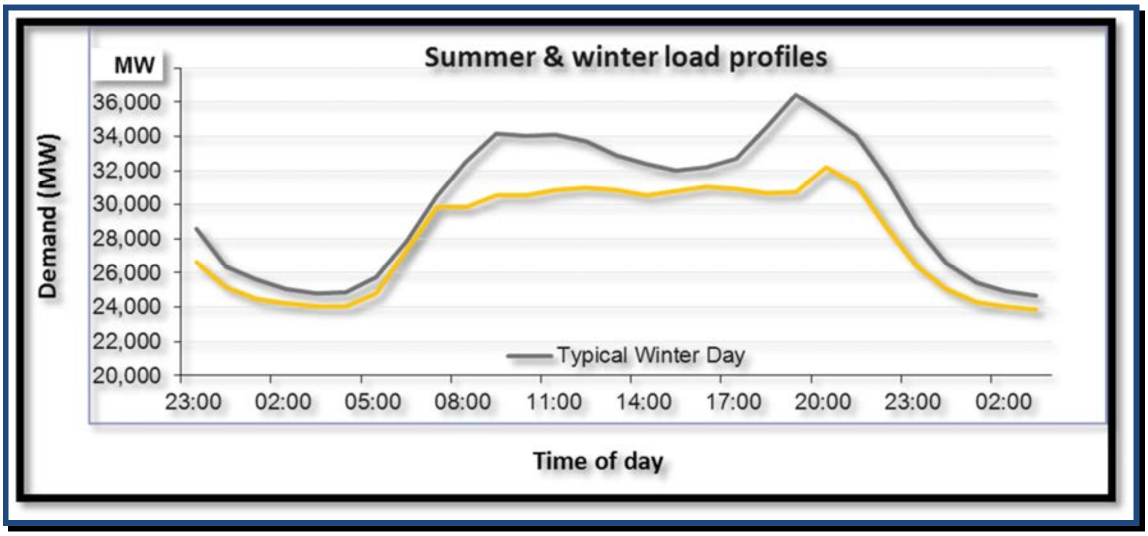


Figure 1-7: Typical summer and winter profiles in SA (8)

1.5. HISTORY OF ENERGY EFFICIENCY / DSM IN ESKOM

Based on international experience with DSM, Eskom developed its own EEDSM initiative, which was necessitated by the need to create a long-term mitigation strategy to minimise the risk of load shedding and to secure the electricity supply nationwide.

These have become the key responsibilities of DSM interventions, driven by the cost and time constraints associated with electrical energy savings. Over the past decade the Eskom DSM Initiative has collectively motivated the savings of electricity nationwide.

The initiative has seen the national political sector, the energy regulator (NERSA) and major economic sectors coming together collectively with Eskom to drive and manage the effort. The DSM initiative strives to provide a long term solution to the supply/demand situation by creating a more energy efficient lifestyle for consumers, to the entire energy management system of the country. This will prove beneficial to all areas affected by electricity supply.

It was determined that the evening peak of electricity usage should be addressed by demand savings initiatives within the mining, industrial and commercial sectors in South Africa using ESCOs as implementation agents. This was the main focus of the DSM department along with implementing a Hot Water Load management system within local municipalities.

The electricity crisis in the Western Cape in 2007, sparked a greater need for electrical energy savings in the peak demand period. This was when DSM recognised and initiated a greater urgency in their programme. Despite this, January 2008 motivated a higher emphasis on implementing savings throughout the day, which diverted the attention to energy efficient projects, specifically those that could be implemented in the shortest time. The greatest savings have been generated through the initiative of incandescent light bulbs with Compact Fluorescent Lamps (CFLs) being fitted in homes nationwide between 2003 and 2009 (9).

The supply/demand gap may be practically addressed and closed with such continued DSM initiatives provided there is no decline in adequate funding to DSM. Electricity prices are foreseen to increase gradually over coming years, however it should not be taken for granted that this will result in a definite change of consumer choice towards a more energy efficient lifestyle. Electricity may be regarded as a "priceless" resource to consumers who may willingly use electricity, despite price hikes.

It is imperative to initiate and maintain an electrical savings mentality in every area of energy usage in order to minimise energy consumption and reduce the risk of load shedding, thus securing an uninterrupted energy supply to all consumers. From a business perspective, DSM is extremely beneficial to South Africa because DSM measures have proven to be:

- the most cost-effective mechanism for demand reduction;
- to have the least economic impact;
- to take the quickest time to implement;
- one of the most effective climate change mitigation strategies; and
- A strong resource to improve overall energy productivity.

1.6. OPPORTUNITY FOR ELECTRICAL ENERGY EFFICIENCY IN SA

Since inception to the end of financial year 2012, the DSM programme in South Africa has realised a verified demand saving of 3076 MW (10) as at 31 March 2012 (Figure 1-8). This is almost the equivalent of a six unit coal fired power station. A single power station's generator unit contributes about 600 MW to the national grid. In the past five years demand-side management has "freed up" more than five generators (a typical power station has six).

The targets were achieved as a result of the various technologies that were installed, ranging from CFL's to optimisation of processes at deep underground mines. The residential sector has achieved the greatest savings of 2333 MW. This was achieved via the installation of a mass rollout CFL programme, installation of solar water heaters using a rebate scheme, and offering heat pump incentives.

The industrial sector has achieved savings of 596 MW via the installation of efficient lighting systems, motor systems, heating ventilation and cooling (HVAC), compressed air systems and process optimisation. The commercial sector has achieved savings of 125 MW via the installation of efficient lighting, motor systems and HVAC systems. The agricultural sector has achieved savings of 18 MW via the installation of efficient pump systems (11).

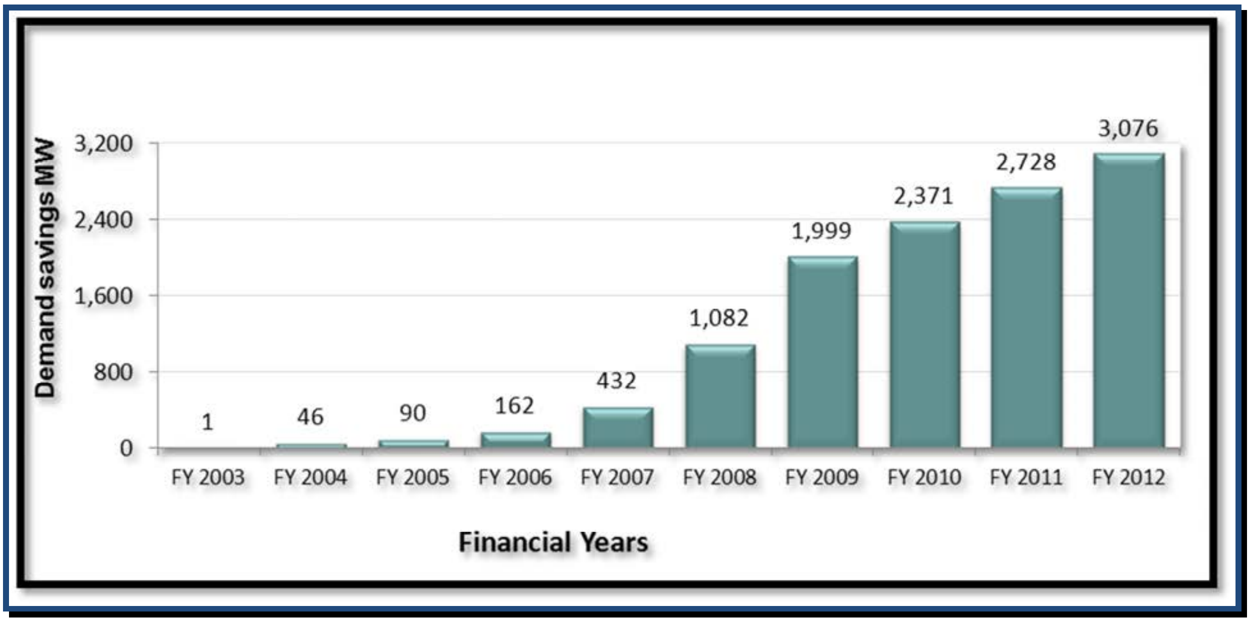


Figure 1-8: Demand savings (MW) achieved since inception of DSM (11)

From the achievements to date, it is clear that more needs to be done in the industrial, commercial and agricultural sectors, as these comprise medium to large power users. A market survey conducted by IDM (12), showed there is a market potential for demand savings of 700 MW and 3565 MW in the commercial and industrial sectors, respectively. However when setting targets for these sectors, it would be realistic to assume a market penetration of 50% due to EEDSM barriers explained in chapter two.

1.7. MOTIVATION FOR THIS STUDY

From the information provided in this chapter, the need for this study can be summarised as follows:

- South Africa faces an energy shortage in the next three to five years due to the demand for electricity exceeding supply.
- The industrial sector has achieved a total demand saving of 596 MW versus a 50% market potential of 1782 MW.
- The commercial sector has achieved a total demand savings of 125 MW versus a 50% market potential of 300 MW.
- The ESCO funding model is lengthy, time consuming and lacks transparency, resulting in poor market uptake to generate good energy efficiency projects.
- The industrial and commercial sector presents good opportunities for energy savings, especially by implementing a streamlined funding model.
- A new procedure is required that will address the problems experienced by both customers and ESCOs; this will lead to better market uptake.

1.8. OBJECTIVES OF THE STUDY

The study will focus on the development of an innovative streamlined management and funding model that will:

- increase market uptake on EEDSM in South Africa;
- reduce the burden on Eskom staff;
- reduce Eskom's risk by paying for performance;
- improve the time taken to evaluate EEDSM projects.

1.9. SCOPE OF THE STUDY

The scope of the study entails:

- Investigating the barriers facing both customer and ESCOs with regards to EEDSM.
- Analysing the issues/problems with the current ESCO process.
- Developing a new process to overcome the challenges faced with the ESCO process.
- Applying and testing the new process on a large retail facility (commercial) in South Africa.
- Analysing the results of the new process in terms of market uptake, time taken to approve and budget commitments.

1.10. LAYOUT OF DISSERTATION

Chapter 1 – **Introduction -** the introduction provides a background to the study. This includes an overview of global and national electricity consumption problems and the need for energy management in South Africa. The demand savings contribution from the commercial and industrial sectors is introduced versus the market potential, thereby presenting an opportunity for a new process to stimulate market uptake.

Chapter 2 – **Demand Side Management** - this chapter provides an insight to international best practice on Demand Side Management, lessons learnt and barriers to market. It also explains the South African ESCO funding model and issues therefrom.

Chapter 3 – **Preliminary investigation into the development of the new process -** this chapter provides an insight into the SO approach. It also investigates areas of overlap and synergies between current IDM processes.

Chapter 4 – **The SO Model, a new process for implementing EEDSM -** the new SO process is introduced. It takes the reader through the full development process and explains each activity flow. The SO process is compared against the ESCO funding model in order to assess evaluation times, process effectiveness, critical controls, roles and responsibilities.

Chapter 5 – **Results -** the new SO process is implemented and verified on a commercial facility.

Chapter 6 – **Conclusion** - this chapter concludes the study with market uptake results of the Standard Offer Programme, and recommendations for future work to ensure future security of supply.

Chapter 2

2. DEMAND SIDE MANAGEMENT

2.1. INTRODUCTION

This chapter provides an insight into international best practice on Demand Side Management (DSM). It provides an overview of DSM, and the evolution thereof. Thereafter the research investigates DSM from a South African perspective, which includes the country's goals and objectives, needs and benefits, barriers to market and the NERSA policy. It also explains the ESCO funding model process and the challenges experienced by industry.

2.2. OVERVIEW OF DEMAND SIDE MANAGEMENT

DSM may be described as a method of influencing the demand for electricity via policies, programs or actions, which alter consumer's electricity usage in a positive way (13). An immediate benefit of DSM to a consumer is its ability to reduce high electricity input costs. Utilities often view DSM as a more attractive, cost effective and environmentally friendly option compared to supply side generation.

DSM collectively encompasses many, "load shape objectives" namely, Load Management (LM) and Energy Efficiency (EE), which collectively assist in the reduction of energy consumption by customers. There are essentially four, "load shape objectives" encompassed within DSM. These are:

- Load Management objectives which are classified as mainly Peak Clipping, Valley Filling and Load Shifting.
- The saving of energy is referred to as energy efficiency, also known as energy conservation, which is the process of lowering the total energy used. Figure 2-1 illustrates the four load shape objectives commonly associated with DSM (14).

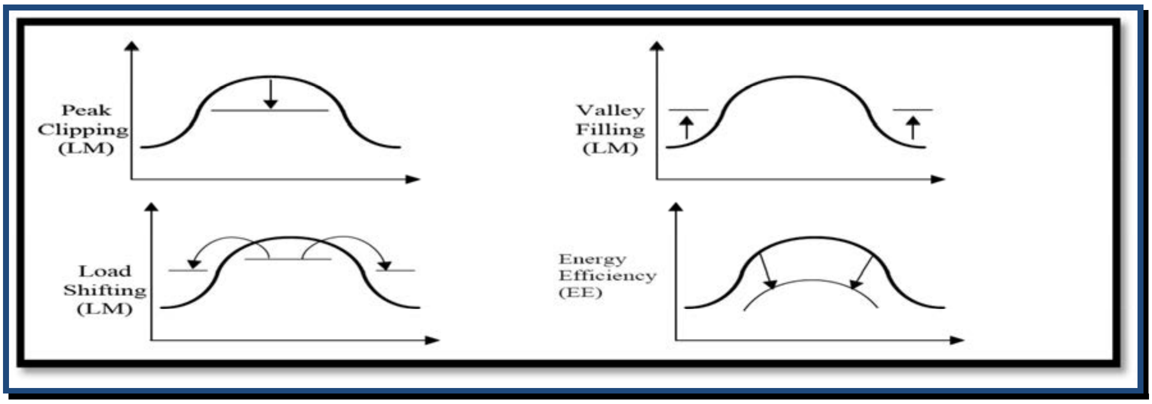


Figure 2-1: Load shapes associated with DSM (14)

2.2.1 LOAD MANAGEMENT

Load management programs may either reduce electricity peak demand or shift demand from on peak to non-peak periods. Various mechanisms are used in Load Management programmes to provide relief to utilities during peak periods of consumption. Such methods include interruptible load tariffs, time-of-use rates, real-time pricing, direct load control and voluntary demand response programmes. They are designed to help control consumption through price control (14).

Time of use (TOU) electricity tariffs contribute significantly to the effectiveness of load management systems and their success in lowering demand during peak periods. This reduction in demand also contributes toward a reduction of power supply construction costs associated with utilities. Load management programs coupled with end-use energy efficiency will result in higher combined savings, whilst still working as a cost-effective demand side solution.

2.2.2 ENERGY EFFICIENCY

Energy efficiency entails the reduction in overall energy use whilst maintaining or improving the level of production output. Energy efficiency improvements involve the replacement of inefficient technologies with efficient technologies that permanently reduce electrical energy consumption during operating hours.

In general most consumers of electrical energy have hidden electrical problems that lead to wastage of electrical energy, mainly; compressed air leakages, dirty plant filters, poor insulation, misconfigured operating controls or even broken equipment, which are often overlooked (15). To improve electrical energy efficiency consumers need to (16):

a) Understand present usage of electrical energy, which entails analysis of electrical usage at the point of purchase and at the point of use.
b) Benchmark plant performance against similar plants in terms of electrical input cost versus production output.
c) Understand when electrical energy is used; most medium to large power users are on a TOU tariff, which means they are charged cheaper electrical rates between standard and off-peak times of the day as compared to peak times. By understanding where energy is being used, consumers can shift plant production from peak to off-peak times.
d) Understand where electrical energy is used by compiling an inventory of all electrical loads, and thereafter determine how much electricity is used per load. Good savings opportunities are identified by targeting high consuming loads first.
e) Match electrical usage to plant requirement by what is used to what is needed.
f) Maximise plant electrical system efficiencies by ensuring all plant equipment i.e. pumps, compressors, and electric motors are operating as efficiently as possible.

There are many benefits in opting for energy efficiency, as opposed to opting for new supply options. Energy efficiency has proven to be more cost effective, speedier, safer and more reliable. New supply requires construction of new generation, distribution and transmission infrastructure. Energy efficiency effectively allows for these costs to be bypassed in addition to reducing costs associated with the maintenance and replacement of equipment. This is due to the longer life-span of energy efficient products as compared to other technologies. Many of the risks associated with generation, which often create high costs for operators, are also effectively avoided through energy efficiency (17).

Efficiency may be achieved from small scale interventions such as fitting energy efficient light bulbs, to larger interventions such as energy efficient process optimisation at deep underground mines.

2.2.3 EVOLUTION OF DSM

Steep increases in fuel prices, inflation and interest rates in the 1970s severely affected many utilities' ability to finance, operate and maintain electrical systems. To be financially sustainable, utilities increased electricity tariffs. This was met with drastic change in the behaviour of users who protested by decreasing energy use, resulting in incorrect costing and demand forecasting for the utilities, which were the initial basis of the planning process. Inaccurate projections coupled with the difficulty of resource planning started to become a major concern for utilities at the time (18).

To address the situation, utilities began to develop energy saving programmes. The driving forces of such initiatives were based on the use of energy efficient technologies coupled with customer communication on energy saving. Unfortunately these initiatives were unsuccessful as they were not as user friendly as envisaged.

A more customer orientated option was DSM, which holistically considered utilities, the needs of customers and the available technology options of the time.

The optimisation of the demand interface by utilities through the development of a logical framework that doubled as a marketing strong-point in which supply-side planners were persuaded to look at demand as a variable commodity. This framework was able to accommodate changes in supply and demand requirements at the same rate, and not in isolation.

By the 1990s Load Management, energy conservation and energy efficiency were collectively understood as DSM. They aimed to decrease the need for electrical energy and generation capacity. Research has shown in the United States alone, by 1993, more than 20 million participants were involved in more than 2300 DSM initiatives, which had been launched by a minimum of 600 utilities. Annual expenditures were measured in the billions of dollars, energy savings were measured in billions of kilowatt-hours and peak load reductions in thousands of megawatts (18).

The focus on DSM was however short-lived and shifted more towards the idea of reducing costs and a better reliance on utilities. International competition, environmental compliance and power-quality concerns prompted customers to search for technology solutions. There was a greater emphasis placed on the reduction of costs by wholesalers and this added pressure on utility executives.

DSM was not seen as a useful aid toward market expansion as it was implemented purely as an energy efficiency option. Utilities viewed unregulated energy service businesses as goldmines and spent endless amounts of money pursuing these options with little consideration for regulated, retail clients. In some cities, efficiency programs were mandated by the energy regulator, thereby forcing compliance, whilst in other cities, institutions were developed to encourage energy and technology research.

With the new millennium, utilities tended to stray from customer DSM programmes and it was only those mandated by law that remained in existence. Today, the focus of utilities has reverted to customer retention by understanding customer segmentation and developing DSM programmes attractive to those segments; as a result DSM is once again growing and having a positive impact on the environment (18).

2.2.4 GLOBAL BARRIERS TO EEDSM

The lack of participation from financial institutions globally has had a negative impact in many countries on the achievement of EEDSM (19). Loans for EEDSM are not easily available as they are regarded as high risk transactions, due to the motivation for the loans stemming from expected savings from reduced energy consumption. Neither are these loans asset-based, thus seeing financial institutions being more reluctant to assist in the process. Split-incentives are more widely received in many areas as they see two parties in a transaction meeting halfway to implement energy savings. A typical example is where a residential developer installs EE equipment and potential owners and investors cover the cost of everyday usage. There are also many other barriers to energy efficiency investment (19) which include:

- High project development costs with payback periods greater than five years, which have a negative impact on investing in EEDSM projects.
- Limited demand for EE goods, whereby the unit cost per item remains expensive, which reduces the potential to negotiate on economies of scale.
- Limited financing institutions that understand the benefits of EE.
- Perceived risks of implementing new technologies.
- Other higher return projects have lower risks and are more attractive.
- Procurement policies favour lowest cost equipment and do not consider the long term running costs of the equipment.

- Import duties on EE equipment result in higher prices.
- Lack of appliance standards and building EE codes.

Another contributing factor towards a gross market failure in EE, is the lack of information to invested parties. DSM and ESCOs were designed to combat such challenges, but need to be further educated on the primary needs of investors. ESCOs need to tailor-make solutions to accommodate different communities and their specific needs in order to have the maximum desired effect. Due to this technicality in promoting EE, the full desired potential is yet to be reached on an international scale (19).

2.2.5 IMPLEMENTATION CHALLENGES TO EEDSM IN DEVELOPING COUNTRY'S

Developing countries are further disadvantaged by additional barriers to EE; this includes informational, financial, technical and behavioural barriers (19). Examples of which are:

- Information about EE technologies are not widely communicated nor are they widely available in developing countries and what is, is not of the best quality.
- Many developing countries are unable to afford the costs that accompany efficient technologies; neither are they able to access funding to support these ideas.
- The role of government is very important in the success of EE in a country and lack of participation by governments in the form of policy or financial incentives, leads to a lack of success of EEDSM.
- Developing countries are presented with many contrasting issues that prevent a consensus on how to promote EE topics, such as informational issues, financial issues including incentives or subsides, market-based initiatives and regulations.
- Developing countries face other pressing issues, such as food and water security; hence prioritising EEDSM is not a high priority.
- ESCOs were designed to assist a general target market and developing countries need to adapt such structures to suit their target markets and requirements. The implementation of such programs without considering local needs such as supplier development and localisation, results in a lack of success and additional frustrations, which in turn result in a reluctance to re-try.

- The diverse economic and social make-up of developing countries make it difficult for them to be compared at international levels, which results in further difficulties in ascertaining their needs and the potential for EE improvements.

2.2.6 INTERNATIONAL OUTLOOK ON DSM

EEDSM has been implemented successfully in more than thirty countries. This has resulted in many countries deferring the need to build new coal fired power stations, thereby contributing positively to a greener environment.

In the United States (US), the Arab oil embargo of 1973 triggered the implementation of EEDSM, which resulted in positive growth in that economy. In 2000, the countries energy intensity index when compared to year 1975, reduced by forty percent thereby making EE the country's largest growing energy resource when compared to oil, gas, coal and nuclear energy (20).

Towards the latter part of 1980, the US implemented more than 1,300 EEDSM programs, which resulted in reducing the peak load by 1.4 percent. Between 1985 and 1995, more than five hundred utilities started to implement EEDSM programs, thereby reducing peak load by 29 GW. Seeing the benefits of EEDSM, utilities in the US began increasing their investment in EEDSM from 900 million US dollars in 1990, to 2,700 million US dollars in 1994 (20).

In Australia, electricity generation is predominately from coal, which is used to power large aluminium plants. The cheap supply of electricity from coal has resulted in high energy consumption and low focus on EE. This situation has created a good market for Energy Services Companies to target customers with high energy consumption.

In Indonesia, the country focuses mainly on the residential sector to clip peak loads. The EEDSM initiatives are targeted at household lighting and appliances, as well as street lighting. Similar to other countries the Indonesian government acknowledges that EEDSM programs (including labelling of appliances) is cheaper than building new power plants; therefore strong focus is on creating awareness of EEDSM (17).

2.3. EEDSM IN SOUTH AFRICA

Prior to 2003, due to the prevalence of surplus generation capacity and the perception that EE could erode Eskom’s revenue and profitability, DSM was not viewed as a priority in South Africa. Promotion of energy efficiency was undertaken as a ‘PR’ exercise rather than a business priority (9). As per Figure 2-2, the first approach into DSM in South Africa began in 1990 with the introduction of TOU tariffs.

In 2003, the threat of capacity (MW) deficits was brought to the forefront when electricity demand increased sharply, especially during winter. It was realised preventative action needed to take place before shortages became a real problem.

To address this issue, the National Electricity Regulator of South Africa (NERSA) and Eskom reached an agreement regarding the formal implementation of DSM in 2003. NERSA then developed goals and guidelines in the form of a policy in 2003 that were carried out by Eskom from 2004 onwards. The main idea was to shift high electricity usage from peak demand periods to off peak periods. Annual targets were set at 152 MW (21).

As per the policy set out by NERSA, Eskom was allowed to fund customers via qualified ESCOs. Load shifting projects could be subsidised up to 100% in terms of start-up and installation costs, and energy efficiency projects by up to 50%. ESCOs at the time mainly targeted municipal ripple load control and industrial/mining projects. The real savings per DSM project were recorded and tracked by a technical audit department at Eskom.

Year 2005 saw the implementation of a new incentive programme for industrial customers and municipalities. This was in the form of the Demand Market Participation (DMP) programme. A reduction in electricity consumption by active participants was rewarded with financial compensation when requested by Eskom’s System Operator.

In 2006 a very aggressive DSM intervention was implemented in the Western Cape to cope with the capacity shortfall in the region brought about by a technical failure at the Koeberg power station. The DSM intervention in the Western Cape consisted of the following:

- A mass-roll out of 5.5 million EE compact fluorescent light bulbs in the residential sector.

- A “Power Alert” was promoted through television broadcasts to illustrate constraints on the electrical grid so that consumers could become actively involved in reducing electricity consumption.
- Gas stoves were subsidised and made available at exchange points in order to reduce electric usage during cooking times.
- 20 000 geyser blankets were given to residential consumers in order to reduce heat losses from electric geysers.

In 2007, the Western Cape DSM programme was extended to other provinces in light of the potential energy shortage the country faced. Subsidised Solar Water Heating (SWH) was actively promoted at this time to reduce peak demand for electricity and also to make it affordable for home owners to purchase a unit.

Load shedding in January 2008 showed the gains achieved through the DSM programme were not sufficient to address a system in crisis, and the Power Conservation Programme (PCP) was subsequently developed to ensure electricity demand would be kept to manageable levels.

Following the restoration of system stability in May 2008 and the lower electricity demand brought about by the economic downturn and increased tariffs; it was decided by government not to implement PCP. A Voluntary Energy Conservation Scheme with Eskom’s Top 250 customers was however introduced.

Eskom continued to pursue EEDSM initiatives within the established NERSA frameworks and targets. However, greater emphasis was placed on EE programmes than on load management programmes, as electrical constraints were being experienced throughout the day and not just in peak times.

Eskom used television broadcasts and the Internet to communicate energy status and electrical grid constraints as well as EE savings achieved, and gave regular updates on the building of the new power station.

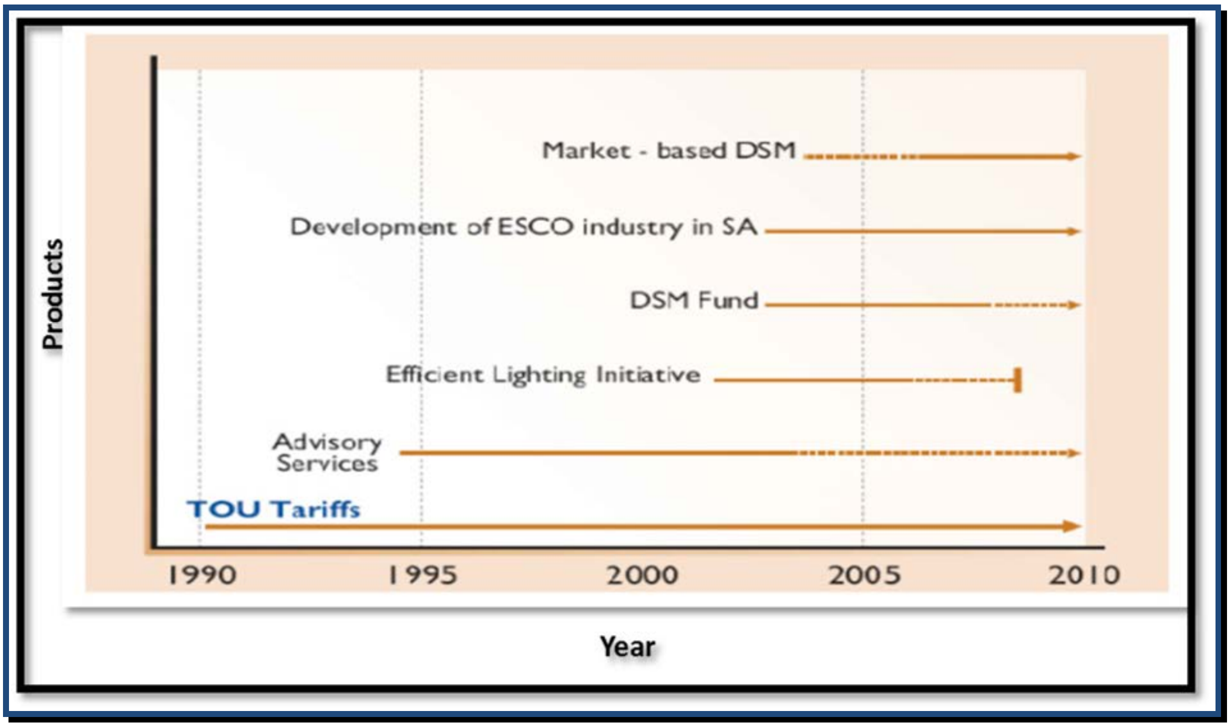


Figure 2-2: Timelines of DSM in SA (22)

2.3.1 THE NEED FOR EEDSM IN SOUTH AFRICA

A large percentage of the South African economy is generated from the mining and other energy intensive industries. In order for the economy to grow and strengthen further, any possibility of an energy crisis has to be avoided. Coal is recognised as the predominant fuel source of power generation in South Africa. This overwhelming reliance on coal has brought about damaging effects on the environment (23). This has resulted in large amounts of CO_2 emissions and marks South Africa as a major CO_2 emitter per capita globally.

EE and DSM have been recognised by government as vital components in South Africa to establish a strategy of sustainable development. According to the, "White Paper on Energy Policy," published by the South African government in 1998, energy services and products need to be more accessible to consumers in all sectors of the economy (24). Simultaneously, the negative effects of energy conversion on the environment must be considered and avoided wherever possible.

2.3.2 GOALS AND OBJECTIVES OF SOUTH AFRICA'S EE STRATEGY

South Africa's national EE Strategy is to ensure affordable energy for all. This will be achieved by promoting sustainable energy development and efficient use of energy, which will positively impact on human health and the environment (25). It is therefore important Eskom, and in particular IDM aligns with the country's goals and objectives of the strategy by:

- Promoting EE, this will allow for a more positive impact on the environment. A saving of 1 kWh on the demand side leads to a saving of approximately 1 litre of water and 0.9 kg of carbon dioxide at the power station (supply side).
- Creating a market for EE that will lead to employment opportunities for potential ESCOs, installers, suppliers and the youth.
- Ensuring through EE that there is adequate supply of electrical energy for all users, and to consider the poor when requesting tariff increases and implementing EE measures.
- Contributing to the reduction of Greenhouse Gases. An additional benefit of EE.
- Enhancing energy security, through EE that could protect the country against external or international energy supply issues and resultant price hikes, as currently experienced.
- Reducing or deferring the necessity for additional power generation capacity. Currently, the generation capacity is at a level lower than required to satisfy the rising national maximum demand, but overcoming this is achievable through EEDSM.

2.3.3 THE BENEFITS OF ENERGY EFFICIENCY DEMAND SIDE MANAGEMENT (EEDSM) IN SA

The social and economic benefits of successfully implementing EEDSM as seen by IDM and other key stakeholders are highlighted as follows (26):

- Achieving the IDM targets over a sustained period is essential to ensure security of supply in South Africa. The impact of power disruptions and resultant costs on the economic sector are more damaging than funding EEDSM or practising greater levels of efficiency in the corporate sector, which will assist greatly in preventing such disruptions.

- EEDSM provides a cheaper alternative to supply side generation. The unit cost of new capacity generation is far greater than that of the conservation of the same amount through EEDSM programmes. Therefore, it is evident that supply cost of electricity will be substantially reduced through effective DSM strategies.
- EEDSM, through energy efficient technologies can be considered a vital contributor towards the reduction of climate change within a country achieving environmental benchmarks and improving social welfare.
- The lifespan of current energy sources such as coal is extended through effective EEDSM and this in turn allows for the country's economic resources to be efficiently distributed.
- Efficiency in homes may allow for a better quality of lighting, improved quality of refrigeration storage (freshness of food is retained), and positive impact on the environment.
- Buying Time; the most valuable commodity that may be salvaged through EEDSM is its ability to reduce electrical demand in a short space of time, thereby contributing to security of supply. Applying EEDSM measures effectively will give Eskom the opportunity to plan effectively (due to no load shedding) in a less stressful environment. This will allow the company the needed time to make key decisions on building or deferring construction of new power stations.

2.3.4 BARRIERS TO ENERGY EFFICIENCY IN SOUTH AFRICA

According to the National EE strategy of South Africa (25), the barriers to EE in South Africa need to be clearly understood in order to be overcome. Barriers that could impact the development of IDM funding solutions:

- ESCOs are available to conduct energy audits in companies to advise clients on appropriate energy efficiency opportunities available to them, the benefits of these and why they should be pursued. Industry, however, has misconceptions about EEDSM and is reluctant to change any of their existing processes. There is a misconception that a change to EE will bring about disruptions and a lack in productivity and there are underlying fears that previous incompetence may surface regarding neglected energy savings opportunities.

- There are insufficient sources of funding available in South Africa for EEDSM. Experience drawn from international examples has shown that without public or utility funding, EEDSM programmes are not likely to function at optimal levels.

2.3.5 REGULATORY POLICY ON DSM IN SOUTH AFRICA

In 2004, NERSA promulgated the Regulatory Policy on Energy Efficiency and Demand-Side Management (EEDSM) for the South African Electricity Industry (21).

This EEDSM Policy made EEDSM planning and implementation one of the license conditions of all major electricity distributors. The responsibilities and obligations of distributors of electricity and ESCOs were defined in this policy. An independent Monitoring and Verification (M&V) body, accountable to NERSA, was established to ensure EEDSM implementation is audited. The EEDSM Fund is to be administered by Eskom in line with a set of rules as implemented by NERSA.

2.4. THE ESKOM DSM FUND

The Eskom EEDSM fund established by NERSA was considered to be consistent with international best practice (23). NERSA established the following rules and procedures for the deployment of Funds as shown in Figure 2-3.

- Eskom would be required to implement EEDSM as a condition for the approval of Eskom's tariff increases in accordance with the regulatory policy on EEDSM. Eskom would submit an EEDSM rollout plan to NERSA.
- Eskom would establish the EEDSM Fund and recover the direct EEDSM costs from the tariffs in the manner specified by NERSA.
- Eskom would evaluate and approve EEDSM projects submitted by ESCOs and any customers that have internal ESCO capability. This process is called the ESCO process.
- NERSA would approve the benchmark criteria for approval of EEDSM projects by Eskom.
- ESCOs would investigate feasible projects with customers and obtain a Letter of Intent from those customers. A project proposal would then be submitted to Eskom DSM.

- The Independent Measurement and Verification (M&V) would be initiated before implementation of the project to verify the MW reduction and/or energy to be saved per EEDSM project and report to the NERSA, Eskom DSM, and customers.
- ESCOs would be required to have a maintenance or performance Contract with a customer.
- All maintenance costs would be borne by the customer.

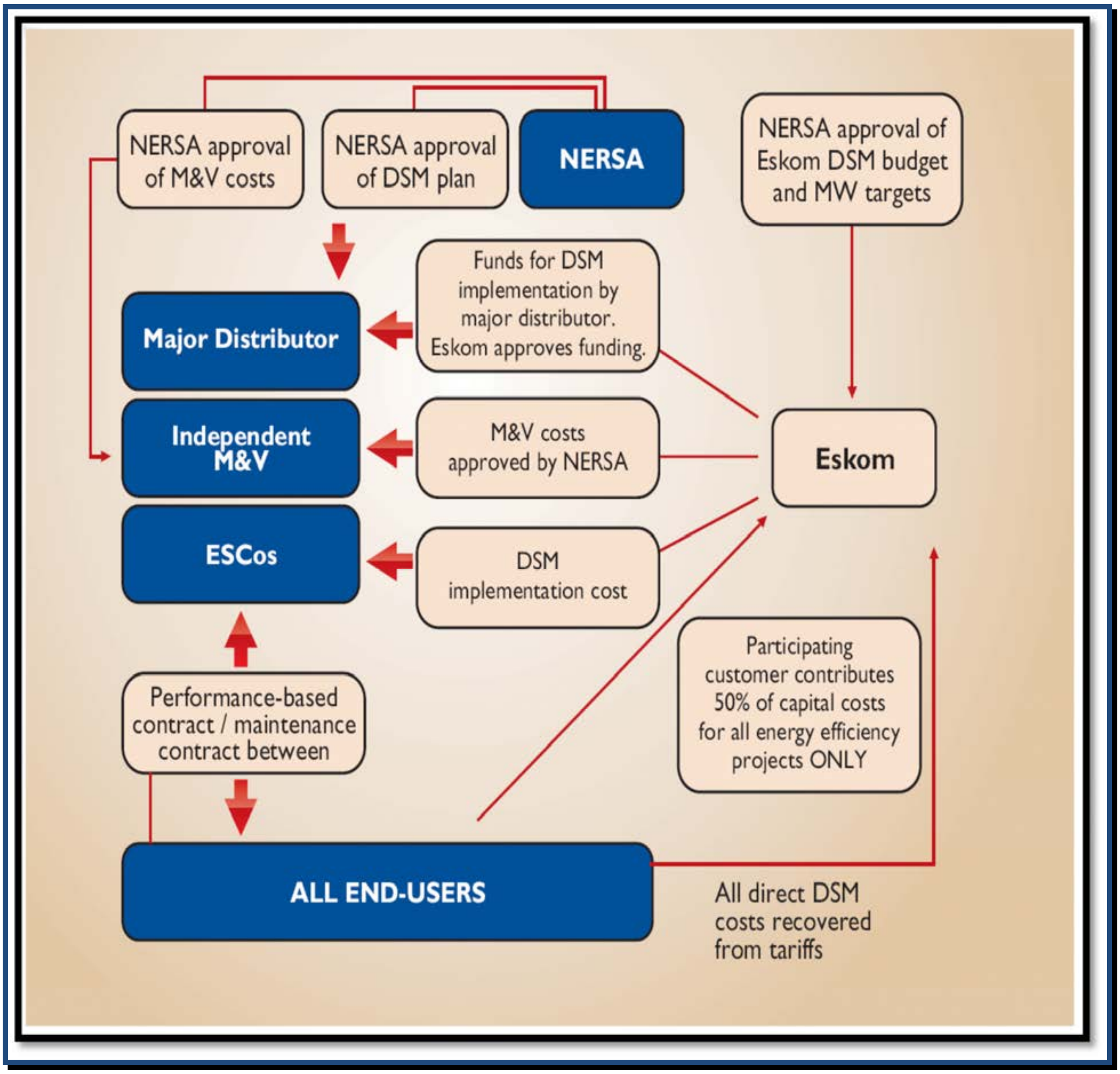


Figure 2-3: Eskom EEDSM fund mechanism (23)

2.4.1 ESCO PROCESS

The ESCO mechanism is targeted at Energy Services Companies (ESCOs) or customers who are specialists in energy management. ESCOs who are accredited by Eskom operate by establishing a three-way partnership between themselves, Eskom and a customer as per Figure 2-4, and use their knowledge of Demand Side Management technologies and programmes to determine the best way of obtaining electricity savings at the customer's premises (9).

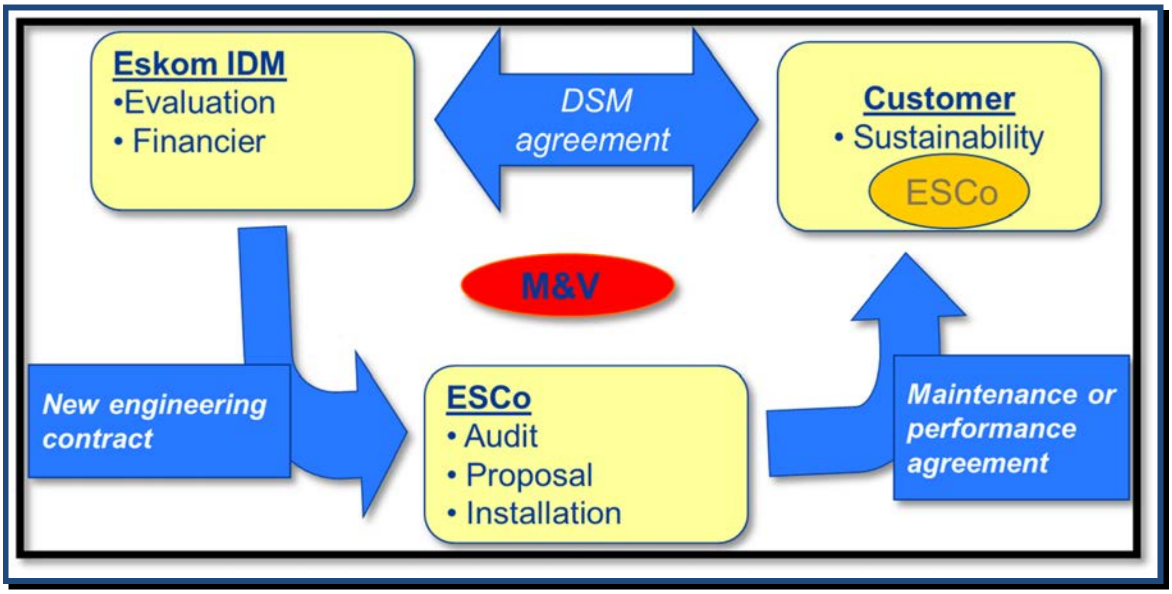


Figure 2-4: ESCO Model (9)

2.4.2 PRINCIPLES OF THE ESCO MODEL

Eskom will, as a service to customers, identify a number of different ESCOs in South Africa on the Eskom data-base, which a customer may appoint to undertake the Energy Studies in respect of its various Installations. The ESCOs being independent, will in its own right and on its own initiative pursue the conclusion of an agreement and the undertaking of the Energy Study directly with a customer and not as an agent or representative of Eskom (9).

Eskom gives no representation or warranty and undertakes no liability regarding the skill, expertise or suitability of the ESCOs to undertake the Energy Study. On completion of an Energy Study and pursuant to the agreement concluded between a customer and the ESCOs, the findings of such study will be presented by the ESCOs to the customer for consideration. Should the recommendations of the ESCOs contained in the Energy Study be accepted by a customer, the ESCOs will submit the Application to Eskom for consideration for and on behalf of the customer.

On receipt of the Application, Eskom will audit the Application for compliance prior to submitting the Application for technical, cost-benefit and financial evaluation as per Figure 2-5, by various committees within Eskom.

Eskom will have absolute discretion to approve or reject any Application. Should an Application be approved by Eskom, Eskom will appoint the ESCOs to undertake the procurement, installation and commissioning of the DSM Measures. Prior to installation of the DSM Measures the energy consumption at the Installation will be measured and verified by the M&V Entity in accordance with the Measurement Guideline.

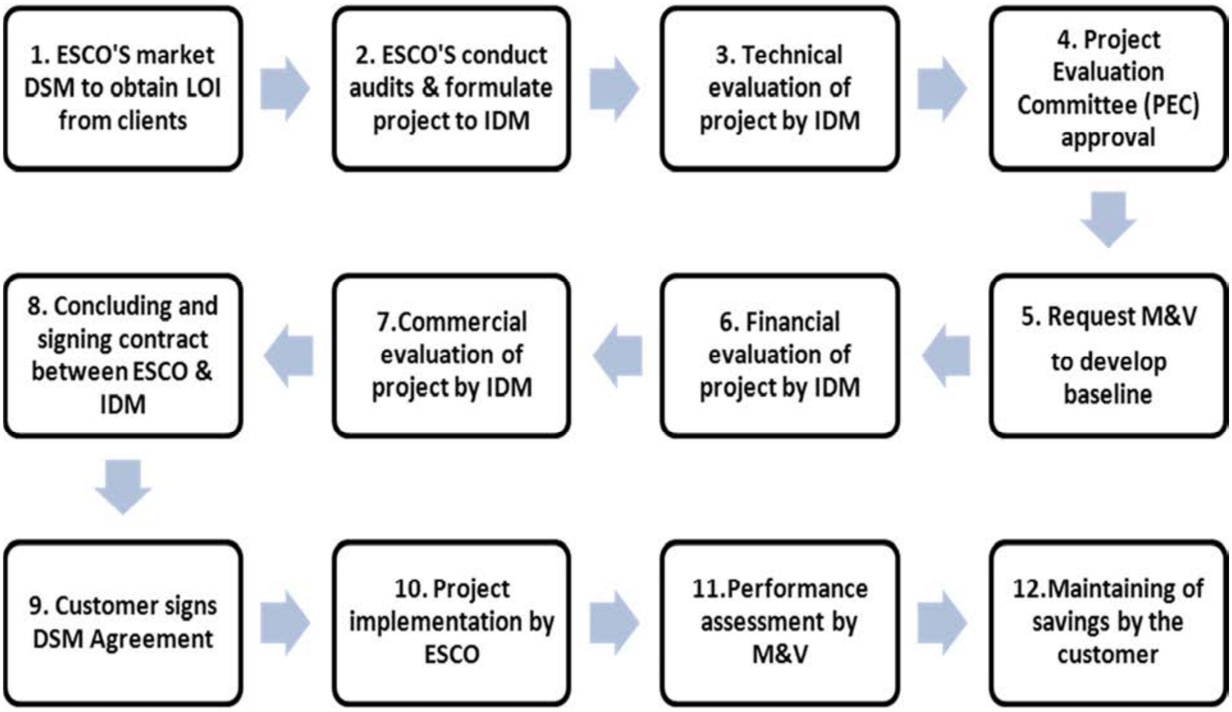


Figure 2-5: ESCO model process flow

2.4.3 ESCO PROCESS CHALLENGES

According to the World Bank group (23) and the local ESCO market in South Africa (27), the biggest challenge experienced with the ESCO process is the time taken by IDM to evaluate projects, which could take up to 15 months.

In general the ESCO model process activities were not well defined (28).The process itself lacked control and transparency. There were no clear roles and responsibilities for the parties involved leading to lengthy approval turnaround times. Table 2-1 presents a summarised view of the typical phases of the ESCO process, with the corresponding timelines to complete the various activities. From the table it can be seen that IDM has major control over Phase 2 (project evaluation) and Phase 4 (contracting), which takes up to 15 months to complete. Although IDM does not have direct control over Phases 1, 3, 5 and 6 it does raise concerns that the time taken on these phases is so lengthy.

Table 2-1: Phases of the ESCO process with corresponding timelines

Phase 1	Activity	Average time to complete activity 1 to 3
(DSM investigation by ESCOs)	1. ESCOs market DSM to obtain Letter of Intent (LOI) 2. ESCOs conduct detailed audit at customer site 3. ESCOs formulate project and submits to IDM for funding	(3 to 6 months)
Phase 2	**Activity**	**Average time to complete activity 4 to 8**
(Project evaluation by IDM)	4. Technical evaluation 5. PEC approval 6. Request M&V to develop baseline 7. Financial evaluation 8. Commercial evaluation	(6 to 12 months)
Phase 3	**Activity**	**Average time to complete activity 9**
Develop project baseline (M&V)	9. M&V to develop project baseline to determine "as is" operation of the facility	12 weeks
Phase 4	**Activity**	**Average time to complete activity 10 & 11**
(Contracting)	10. ESCO signs implementation contract with IDM 11. Customer signs DSM agreement with IDM	(3 to 15 months)
Phase 5	**Activity**	**Average time to complete activity 12**
(Implementation)	12. ESCO implements project at customer site as per the conditions of contract	(project dependent, average – 12 months)
Phase 6	**Activity**	**Average time to complete activity 13 & 14**
(Performance assessment & maintenance)	13. Performance assessment by M&V 14. Customer maintains implemented savings for 5 years	(Up to 3 months)

2.4.4 DETAILS AND CHALLENGES EXPERIENCED WITH ACTIVITY FLOW 1 - 14

As per Table 2-1 the activities/steps in each phase will be discussed together with the challenges experienced with each activity.

- ***<u>Phase 1 - Activity flow 1 (ESCOs market DSM to obtain LOI)</u>***

This activity entails the customer signing a LOI with the ESCO to conduct an audit at the customer's site to identify possible energy efficiency interventions. The LOI has an expiry date, (usually three months) therefore the customer can terminate the agreement if he is not satisfied with the services of the ESCO and could appoint another ESCO.

Challenges with activity flow 1: ESCOs often find it difficult to sell the ESCO model to customers as the programme rules are not transparent or well defined. There is generally a lack of understanding of the risks associated with the ESCO model by the ESCO. In some cases it could take up to 3 months to obtain a LOI from a customer.

- ***<u>Phase 1 - Activity flow 2 and 3 (ESCOs conduct detailed audit and submits project to IDM)</u>***

The ESCO conducts a detailed energy audit which includes the identification of large electricity users, plant layouts, historical data and process flows, which will inform the development of a project proposal. The project proposal details the possible and recommended interventions for electricity demand reduction. After completion of an energy audit, the ESCO produces a proposal on the energy savings initiative to the customer which must be signed off by the customer and thereafter submitted to Eskom for funding purposes.

Challenges with activity flow 2 and 3: ESCOs allocate time and funding to investigate EEDSM projects that may eventually not even be funded by Eskom due to incorrect information. Project investigations could take up to 3 months to conclude. After conducting an energy audit, the customer could also decide not to go-ahead with the project due to budget limitations.

❖ ***<u>Phase 2 - Activity flow 4 (Technical evaluation of project by IDM):</u>***

The first level of evaluation revolves around the technical aspects of the project. The technical team members will check as a minimum:

- That the existing technology at the customer site is well defined.
- That the proposed technology is clearly described including conformance to specifications.
- That the proposed solution increases production (i.e. gives the client a competitive edge).
- That the proposed load profiles are based on actual measured or manufacturer specifications.
- That the methods used to establish the savings are defined.
- That there are variables that could affect the proposed savings ie. production increases, seasonal changes, time of use, commodity price influence.
- What the MW and MWh savings are.
- Whether the proposed savings will be achieved monthly or yearly and in winter or summer.
- What the estimated Implementation period of the project is.
- What the monetary savings to the client due to the intervention are.
- What the lifespan of the company or mine is.

Challenges with activity flow 4: there was insufficient staffing in the technical section of IDM to evaluate projects; hence staff could not cope adequately with the incoming workload. Good commercial sector EE projects were being disqualified because they operated outside the evening peak periods, and there were no incentives to encourage EE projects. Time to evaluate projects could take as long as 3 months. Projects were being registered by TEC personnel, which should have been the responsibility of the project manager (PM).

❖ ***<u>Phase 2 - Activity flow 5 (Project evaluation committee approval)</u>***

On approval from the TEC, the PM would submit the project to the Project Evaluation Committee (PEC) for approval. The PEC has a mandate to only approve the technical aspects of the project. On approval the committee would recommend the project go to the financial and commercial committees for approval.

Challenges with activity flow 5: at the PEC meeting, proposals were often rejected as the PM could not adequately address the questions raised by committee members. Frequent requests for more information had to be made to the ESCO by the PM, leading to delays.

❖ ***<u>Phase 2 – Activity flow 6 (M&V request)</u>***

On approval from PEC, and based on a high confidence level (>90%) that the investment and commercial committee will approve the project, the PM will request an independent Measurement & Verification (M&V) team to develop an M&V plan and baseline report of the project at the customer site.

Challenges with activity flow 6: The M&V teams do not receive a copy of the project proposal from the ESCO, hence it is crucial that the PM supply as much information on the M&V request form. Often the PM did not complete the M&V request form adequately, which led to a misunderstanding of the request.

❖ ***<u>Phase 2 - Activity flow 7 (Financial evaluation)</u>***

Whilst the baseline is being developed, the PM will submit the project to the financial committee. The financial committee evaluates the submission against the NERSA benchmarks and the Eskom financial plan. The committee ensures there are funds available to support the application, as well as to check the cash flow for the project. The committee also checks the correct governance process is followed and that all possible risk are identified and mitigations are in place.

Challenges with activity flow 7: No major challenges were experienced with activity flow 7.

❖ ***<u>Phase 2 activity flow 8 (Commercial evaluation) and phase 4 Activity flow 10 (ESCO signs contract with IDM)</u>***

On approval from the Finance committee, the project is submitted to a project buyer at the commercial department. The appointed buyer will check the project for:

- Tax Clearance and VAT registration Certificates
- Compliance with the Construction Industry Development Board certificate (CIDB)
- Financial statements
- BBBEE certificates
- Detailed cost breakdown and cost comparisons with similar projects
- Compliance to Supplier Development and Localisation (SD&L) objectives

Once checked the buyer will prepare a mandate for the Procurement Tender Committee (PTC) approval. At PTC, the mandate is either approved or rejected. If approved the buyer will negotiate a discount and conclude a contract with the ESCO, after which the New Engineering Contract (NEC) is drawn up and signed by Eskom and the ESCO. The main terms of the NEC include:

- Contract value
- Project start and end dates
- Scope of work (SOW)
- Retentions – (normally 7.5%. of which 5% will be released on project completion and 2.5% after measure acceptance date)
- Requirements of the project
- Site information
- Project Plan and deliverables and milestones
- Penalties for non- performance on the proposed savings

Challenges with activity flow 8 and 10: the commercial department did not negotiate contracts in a simple, time efficient manner. The requests for discounts during negotiations led to delays. ESCOs price a project on benchmark values and did not understand why discounts should be given. New requirements were implemented without the knowledge of the ESCOs. The commercial process for EEDSM funding was lengthy and slow and could take up to 12 months to complete. A buyer had to evaluate a project in detail to determine whether the costs as submitted were in fact correct or if the ESCO was making a profit that was not in line with expectations. In some cases this took many months as the ESCO had to justify the costs in processes that Eskom staff had little or no expertise in. Thus it was very difficult for Eskom to decide on a cost to provide to the ESCO. The NEC penalties do not encourage over performance on projects; the ESCO was penalised for underperformance and there were no rewards for over performance. In addition, in many of the cases, the ESCO had committed to a price that Eskom would pay to a customer and now had to go back to the customer with a revised cost. This led to further delays.

❖ ***<u>Phase 3 - Activity flow 9 (M&V baseline development)</u>***

Following on the M&V request from the PM, the M&V team has to develop the plan and baseline report at the customer site. The goal of this process is to establish a baseline from which to measure future savings. The customer and the ESCo have to agree with, and sign off on the M&V baseline.

Challenges with activity flow 9: At times, due to workload, the M&V teams could not go to site to conduct baseline measurements as planned. The cost of the metering equipment could also be costly as compared to the project cost and size

- ***<u>Phase 4 - Activity flow 10 (ESCO signs contract with IDM)</u>***

This step including the challenges is discussed under activity flow 8.

- ***<u>Phase 4 - Activity flow 11 (Customer signs DSM agreement with IDM)</u>***

Following the evaluation procedures, the next step is for the customer to sign the DSM agreement. This takes into account the savings as measured against the signed off baseline, as well as highlighting the main penalties imposed for the non-achievement of the expected savings, termination of the contract and penalty for a permanent reset of the baseline. The standard duration for these agreements is five years. The customer's obligation starts on the Measure Acceptance Date (MAD), whereby the project risk is transferred by the ESCO to the customer.

Challenges with activity flow 11: The DSM Agreement which has to be signed between Eskom and the customer is onerous, leading to more delays as both the customer and Eskom legal teams need to vet it. This activity could take up to 15 months to complete while the customer's legal team might insist that Eskom change clauses in their favour.

- ***<u>Phase 5 - Activity flow 12 (Project implementation)</u>***

Prior to implementation starting, it is important for the PM to check the Baseline report, DSM agreement and the NEC are all signed. The customer is then required to facilitate the project implementation by providing access to facilities. Implementation begins and progress payments are made to the ESCO on deliverables at site as per the NEC contract. The ESCO will be expected to implement the project in a timeous and professional manner.

Project implementation may take up to 12 months, depending on the customer and the technologies being implemented. When the project is complete the PM will ensure a completion certificate is signed between the ESCO, Customer and Eskom. This confirms the work has been completed as per the NEC contract; at this point Eskom will release the 5% retention to the ESCO. The PM will also instruct the M&V team to verify the actual savings delivered by the ESCO on site.

Challenges with activity flow 12: Due to the lengthy approval process, a situation could arise that process changes could have been implemented by the customer from the time the proposal was submitted to project implementation hence changing the initial baseline.

❖ ***<u>Phase 6 - Activity flow 13 (Performance assessment)</u>***

Upon completion of the project, a post-implementation M&V will be undertaken, to ensure the project meets all requirements laid out in the signed contracts. Further M&V is undertaken for a period of three months called the Measure Acceptance Period (MAP).

On successful completion of the project, a customer and the ESCO are then expected to jointly sign a Measurement Acceptance Date (MAD) certificate, at which point the project is officially handed over to the customer. At this point the balance of the retention is released to the ESCO and the risk of the project is transferred to the customer.

In cases where there is a non- performance reported during the MAP by the M&V team, the following criteria will be used to rectify the situation:

- Upon commissioning, the M&V entity will undertake the measurement and verification for a period of three (3) months to ascertain the performance of the proposed system. Where possible, the ESCO will be allowed to fine tune the system to ensure compliance on the MW proposal.
- Should the M&V results be within the acceptable error allowance of 10%, no penalties will be invoked and the performance will then be accepted by both the customer and Eskom DSM. The system's performance MW reduction value will then be used as the system's capability value.
- Should the M&V results be beyond the acceptable 10% allowance error, the ESCO shall be provided with one month's opportunity to rectify the system's performance to an acceptable performance of 90% (minimum). The ESCO shall carry the cost incurred thereof.
- If, on completion of the rectification period, the project's performance is still beyond the acceptable 10% error, penalties shall be imposed by Eskom DSM to the ESCO. The ESCO will be liable to pay the penalties.

Challenges with activity flow 13: ESCOs complain that the Megawatt reduction must be measured between the original baseline and the actual Megawatts after implementation of the EEDSM project (no baseline scaling). Condonable days should be excluded from performance assessment and the assessment period extended with the number of condonable days.

❖ ***<u>Phase 6 - Activity flow 14 (Customer maintains savings for 5 years)</u>***

The customer will officially take over the DSM project on the measure acceptance date and maintain the savings over five years. Eskom will undertake regular M&V monitoring to ensure the project continues to go according to plan and meets the accepted baselines, while the customer’s role will be to sustain the project over this period as per the requirements of the DSM agreement.

Challenges with activity flow 14: it often happens that projects that performed during the PA, start to underperform during the maintenance phase. The main reasons could be:

- Lack of personnel to take over the DSM measure.
- Limited knowledge by the customer of the installed technology.
- Shortage of skilled resources to maintain equipment.
- Limited interest from site personnel, who may only be interested in production targets and safety.

2.5. CONCLUSION

Chapter 2, provides an insight into international best practice on Demand Side Management, lessons learnt and barriers to market implementation. It also explains the ESCO funding model and challenges thereof.

Both locally and internationally, EEDSM has proven to be a critical lever towards ensuring balance between supply and demand. Every effort must be made by all stakeholders, particularly national government, Eskom and NERSA to address the barriers to EEDSM in order to ensure future electricity supply.

In the opinion of many ESCOs, Eskom appeared to be a barrier to EEDSM implementation rather than being a facilitator of EEDSM projects. Furthermore, the large uncertainty and delays in the Eskom evaluation process created risks and made many projects difficult to finance and implement.

In the next chapter a preliminary investigation into the development of a new process is conducted in order to address the challenges of the ESCO process and increase the level of EE in SA. The chapter will also investigate areas of overlap and synergies between other IDM processes and funding models.

Chapter 3

3. PRELIMINARY INVESTIGATIONS INTO THE DEVELOPMENT OF THE NEW PROCESS

3.1. INTRODUCTION

It was shown in Chapter 2 that the need exists for a new process to evaluate EEDSM projects based on the challenges experienced with the ESCO process. Preliminary investigations were conducted to identify solutions to addressing the challenges experienced in approving EEDSM projects. An international scan was conducted and one of the solutions to reduce the overall time from application to execution was the introduction of the Standard Offer (SO) process.

Global research shows other countries have implemented SO successfully. In this chapter the new SO process is introduced. It will look at:

- International experiences with SO.
- An environmental scan towards the development of SO in South Africa.
- Possible barriers to SO in South Africa.
- Possible overlaps/synergies with other IDM initiatives.

3.2. WHAT IS A STANDARD OFFER?

According to an international definition (23), "The Standard Offer is a mechanism for acquiring demand-side resources (EE and load management) under which a utility (or a government agency) purchases energy savings using a pre-determined and pre-published rate in cents per kWh based on verified savings. Any energy user (utility customer) or ESCO that can deliver energy savings is paid the fixed amounts per kWh (the Standard Offer amounts) upon completion of the EE project and certification of the achieved savings by an authorised M&V organisation".

3.3. INTERNATIONAL EXPERIENCE WITH SO

The roots of the SO programme can be traced back to energy regulators in the United Stated (US) who promote the uptake of EEDSM. The funding mechanism of this programme was to offer performance based incentives to customers that reduced energy consumption via the installation of EE technologies. The energy payment for every kWh saved was standard. The condition of contract and requirements of the programme were also standard, hence the name, "Standard offer" (23).

The application of SO as practised in the US varied considerably. Some utilities used SO to target the industrial and commercial sector, whilst other utilities reached out to the residential sector. Some utilities requested customers to use Project Developers (PDs), whilst other utilities allowed customers to be their own PD.

According to the World Bank (23), New Jersey introduced a Standard Offer Programme (SOP) in 1992 and saved almost 1 100 GWh from 1992 to 1997. Currently New Jersey offers attractive incentives to industrial and commercial customers that can reduce peak load by 200 kW via the services of an ESCO.

In late 1999, a law was passed in other parts of the US such as Texas, for utilities to reduce 10% of annual growth in demand through EEDSM. Under the law, SO programs are offered by third parties such as ESCOs, suppliers and contractors to implement EE technologies at a consumer's premises. The EE intervention must produce measured energy and demand savings for a period of 10 years. The utility provided incentive payments based on deemed savings, (theoretically calculated) and not just measured savings. Four years later Texas reported a peak demand saving of 341 MW (29).

California also developed SO contracts in response to the federal legislation, thereby offering attractive rates to the market. However these contracts differed from the conventional SO approach, targeting renewable and cogeneration type of projects as compared to the traditional lighting technology contracts. California went on to offer lucrative tax incentives to renewable generators in the early 1980s, however in the late 1980s the tax incentives had been stopped, leading therefore to an unintended consequence of the SO contracts not being available (30).

3.4. ENVIRONMENTAL SCAN TOWARDS THE DEVELOPMENT OF SOP

An environmental scan was performed to identify pertinent external macro-level issues and requirements in SA that must be taken into account in the design and implementation of the SOP (31). These are:

3.4.1 POLITICAL

Funding from NERSA via a tariff increase is expected to be made available to IDM in support of electrical EE initiatives. Allocation of these funds towards the SOP needs to be discussed and agreed upon between IDM and NERSA. IDM must ensure that the SOP budget will be ring fenced and must not be reallocated to other IDM funding solutions.

3.4.2 SOCIAL

The skills shortage in SA is a major concern; this has an impact on ESKOM. They are required to secure and maintain sufficient personnel with the required skills in management and engineering as well as those in the artisan and technical fields in order to ensure a greater efficiency in the usage of electricity.

Some of the reasons for the skills shortages may be attributed to there being a national and global need for people skilled in those areas. Companies that offer attractive remuneration packages are most likely to receive the bulk of the skills pool. There is also very limited training available to artisans in the EE field as compared to other engineering fields; thereby leaving less than adequate numbers of artisans to work with the latest EE technologies.

3.4.3 TECHNOLOGICAL

To achieve large scale infrastructure development urgently needed to grow the SA economy, technology will be required. This will entail large investments by Eskom and other role players currently involved with energy efficient technologies such as CFL's and other new EE technologies, to create an environment whereby local manufacturing of EE technologies can be encouraged through supply and demand.

3.4.4 LEGISLATION

The Broad-Based Black Economic Empowerment (BBBEE) Act, (53 of 2003), (33) and respective Codes of Good Practice require government departments and state owned enterprises implement black economic empowerment measures to develop and establish black entrepreneurship in the economy. Eskom therefore has to ensure that opportunities are created for BBBEE companies by setting aside a pool of funds for their development. Eskom's policy must support and promote the participation of BBBEE companies in the areas of manufacturing, extraction, EE and professional consulting.

3.4.5 ENVIRONMENTAL

Due to global issues such as climate change, there is a drive throughout the world to achieve a reduction in demand for energy and to improve energy efficiency. The attainment of energy efficiency is deemed to be the fastest, cheapest and cleanest way to extend the world's energy supplies and to reduce greenhouse gas emissions.

There is a growing involvement of environmental pressure groups and other stakeholders who have expectations utilities such as Eskom will improve EE nationally. The effectiveness of these programmes will have to be visible more immediately, as well as sustainable.

3.5. IDENTIFYING POSSIBLE BARRIERS TO SO IN SA

There have been issues identified as possible barriers for the implementation of SO in South Africa and should these not be correctly understood and addressed, could result in the ineffective implementation of the programme resulting in the country not attaining targeted energy savings (31).

3.5.1 BARRIER 1: PERCEPTIONS REGARDING THE COST OF IMPLEMENTING EE TECHNOLOGIES

There are perceptions by commercial and industrial customers that technology based energy efficiency interventions cannot be justified due to the perceived lengthy payback periods. Customers are of the view, even though energy costs are rising the cost of implementing energy efficiency measures relative to the cost of energy, is still high. Energy efficiency measures are often perceived as disrupting production processes. In view of this, EE measures are not actively and rapidly being implemented.

To address this barrier, both Eskom and ESCOs need to demonstrate to energy consumers the benefits that will accrue after the initial capital outlay towards the SO programme is made.

3.5.2 BARRIER 2: VOLATILITY OF THE RAND

Due to volatility of the South African Rand on the currency market, customers find it difficult to appropriately budget for the import of energy efficient technologies. The volatility leads to unwillingness by customers to invest in EE solutions towards the SO approach.

To address this barrier the ESCOs will need to reassure customers by stabilising the costs of EE technologies and taking out the necessary financial forward cover. It is also necessary for the DTI and the SA Reserve Bank to engage on foreign exchange and importation of goods, and to create mechanisms to enable EE technologies to be produced in SA. This mechanism will create much needed jobs in SA, and will stabilise the supply side value chain.

3.5.3 BARRIER 3: SCEPTICISM REGARDING THE EFFICACY OF ESCOs

Customers in South Africa do not show a great inclination to the use of ESCOs to attain the more efficient use of energy. This could be attributed to this being a fairly new concept in this country and there has been no official standardisation of their service levels or expectations in terms of performance. Therefore ESCOs are not the first option in the market when implementing energy or cost efficiency measures.

To address this barrier, the market needs to be educated on the benefits of using ESCOs as well as the rate of successfully implemented plans and projects so they are a more attractive option for commercial and industrial customers.

3.5.4 BARRIER 4: PROTECTION OF TRADE SECRETS BY INDUSTRIAL CUSTOMERS

The need to protect trade secrets has prevented industrial processes being made available to ESCOs by many companies. Therefore ESCOs keep their distance from addressing processes and rather focus on standard technology applications such as pumps, boilers, compressors, etc.

To address this barrier, industrial customers should be made aware that through confidentiality agreements and contracts, they will be well protected against sharing of information with third parties. They should also be given the opportunity to use Eskom to develop and implement their own energy efficiency projects.

3.5.5 BARRIER 5: COMPETITION FOR ESCOs FROM LARGE INDUSTRIAL COMPANIES

ESCOs would benefit most from the larger industrial companies as they could yield larger profits; however, as these companies have their own electrical and mechanical engineers, they move towards implementing their own EE measures in-house rather than using ESCOs.

To address this barrier, the value of ESCOs needs to be highlighted for industrial companies to be encouraged to use them. The ESCOs need to explain the use of in-house resources can also prove to be in-effective as these resources focus on other plant related matters that are more pressing than becoming EE.

3.5.6 BARRIER 6: APPROVAL REQUIRED FROM NERSA FOR THE SOP

The implementation of the SO is dependent on the pricing being worked into the NERSA Multi-Year Pricing Determination (MYPD) application. This can be a time consuming process, which could negatively affect the perceptions of the proposed SO on the market, resulting in consumers declining to take up the concept.

To address this barrier, consultation time with NERSA must be accounted for in the planning stages so it does not delay the process when pricing and principles need to be decided upon.

3.5.7 BARRIER 7: LACK OF AWARENESS AND UNDERSTANDING OF EE TECHNOLOGIES

EE advisors are often perceived as being too expensive to consult with in order to become more educated on the range of energy efficiency products or benefits available. Without the use of these consultants, customers do not have access to enough information.

To address this barrier, EE advisors should offer a low cost or no cost advisory service to customers in an attempt to recover this cost when at a later stage the customer decides to implement EE solutions. Also the advisor needs to create a greater sense of awareness of EE technologies and their benefits to increase a customer's willingness to participate in EE.

3.6. POSSIBLE OVERLAPS/SYNERGIES WITH OTHER IDM INITIATIVES

The implementation of the SO has to be considered against the likelihood there will be are areas of overlap or synergies with other IDM funding models that could lead to confusion in the market; hence understanding the existing funding models is important. Table 3-1 shows a comparison of all IDM funding programmes in SA with reference to project size, target sector and payment structures.

Table 3-1: Comparison of IDM funding options

Programmes / funding models	Description	Project size (MW)	Target sector	Payment structure
ESCO Model	Payment for Demand (MW) savings made to ESCO, based on actual verified savings, with 5 year sustainability agreements with the customer	Generally > 500 kW	Industrial & mining	Progress payments made during implementation. Final payment based on average benchmark of R5.25 million per MW saved
Performance contracting(PC)	ESCOs tender for the installation of large blocks of EE technologies at multiple sites in SA	Total 3 year savings > 30GWh	Industrial and mining, limited commercial applications	Payments based on actual M&V'd savings every 3 months, for a period of 3 years. Payment of 55c/kWh during high rate 10c/kWh during low rate period.
Standard Product (SP)	A rebate is paid directly to the customer for installing predetermined EE technologies.	Ranging from 1kW to 250kW	Commercial and agricultural	Rebate calculated based on number of in-efficient technologies replaced, benchmark rates and estimated load factors. Product lends itself towards a deemed savings approach rather than an M&V'd approach.
Aggregated Standard Product (ASP)	Eskom allows ESCOs to aggregate individual customer projects through a single contract.	Min: 1MW Max : 5MW	Commercial and agricultural	Calculation of rebates the same as the SP. Aggregated payments for every 1MW of delivery.

Programmes / funding models	Description	Project size (MW)	Target sector	Payment structure
Residential Mass Rollouts (RMR)	ESCOs are appointed to replace EE technologies with a "basket" of standard EE technologies in the residential sector	Min: 5MW Max: 20MW	Residential	Payment based on standard pricing of the "basket" of standard technologies.
CFL Mass Rollout	Eskom procures large volumes of CFL's that are implemented via a mass door-to-door campaign at residences	Based on a tendering process. generally >100MW projects	Residential	Payment for CFL's to suppliers based on delivery to site. Progress payments to ESCOs/installers based on actual installation substantiated by audited database
Demand Response (DR)	The DR programme contracts with customers that have flexible load to switch part of their plant operation on request from Eskom. No ESCOs are involved in this programme	Min: 1MW	Large industrial	Multiple fixed rates per MWh reduced are paid to the customer. No capital payment to customer
Power Buy Backs (PBB)	Power buyback would involve Eskom paying industrial customers a rate per MWh over extended periods of time for not consuming power	>10MW	Large industrial	Fixed rate per MWh over a defined period.
Energy Conservation Scheme (ECS)	ECS consumers will receive an energy allocation based on their consumption over a baseline period. Should consumers exceed their monthly energy allocations, excess energy tariffs (penalties) will be charged to discourage excessive usage.	>25GWh/a	Large industrial	No payment

When the proposed SOP is compared with the current IDM initiatives as per Table 3-1, several areas of overlap can be identified. These being:

- The targeted customers being commercial and industrial customers.
- Channels to market via ESCOs.
- Incentives/subsidies are similar.

The target customer overlap occurs in the commercial, mining and industrial sectors. The current IDM programme entails using ESCOs to approach and visit interested customers and at their request, perform energy audits to determine possible EE interventions. The basic premise of the SO programme is also to utilise ESCOs so as to deliver energy and cost savings from commercial and industrial customers.

3.7. CONCLUSION

The development of the SO process needs to be unique to avoid overlap with current IDM programmes. The SO program will furthermore require a fundamental culture and mind shift from an Eskom point of view. One of the critical dimensions of the success of the system is rapid response to deployment of resources. If the system is to succeed to its full potential, authority must be delegated down from senior Eskom management and enforced accordingly.

Chapter 4

4. THE SO - A NEW PROCESS FOR IMPLEMENTING EEDSM

4.1. INTRODUCTION

It was shown in Chapter 2 and 3 that the need exists for a new process to evaluate and approve EEDSM projects by IDM, especially in the commercial and industrial sectors of SA. The new system that will form part of IDM's processes for evaluating projects will therefore need to address the following:

- Increased market uptake for Energy Efficiency
- Streamlined funding approval process
- Reduced burden on Eskom staff
- Reduced Eskom risk by making payments performance-based on measured and verified savings
- Improved time taken to evaluate EEDSM projects

In this chapter the method in developing the new SO process is explained. At Eskom, there are various methods to solve complex situations in order to develop a new process; one of these methods is called the, "Systems Thinking Approach (STA)" by Dr. Julian Day (33). This process entails the understanding of complex situations and how to address them. The benefit of this method is that it leads to **high leverage interventions** whereby managing the right things achieves extensive gains.

On determination of the high leverage interventions, the next step is to develop and align the new process to Eskom's Project Life Cycle Model (PLCM), which is a policy in the company. The PLCM approach is used to govern the management of projects and the approvals authorising the project investment decisions to proceed to the next phase of the life cycle (34).

The PLCM model is a series of sequential phases, which a project passes through from the initiation of the project to the closeout of the project (34). The simplified view of the PLCM as per Figure 4-1 consists of six phases namely; Pre-project planning; Concept Development; Definition; Execution, Finalisation and Post project benefit realisation.

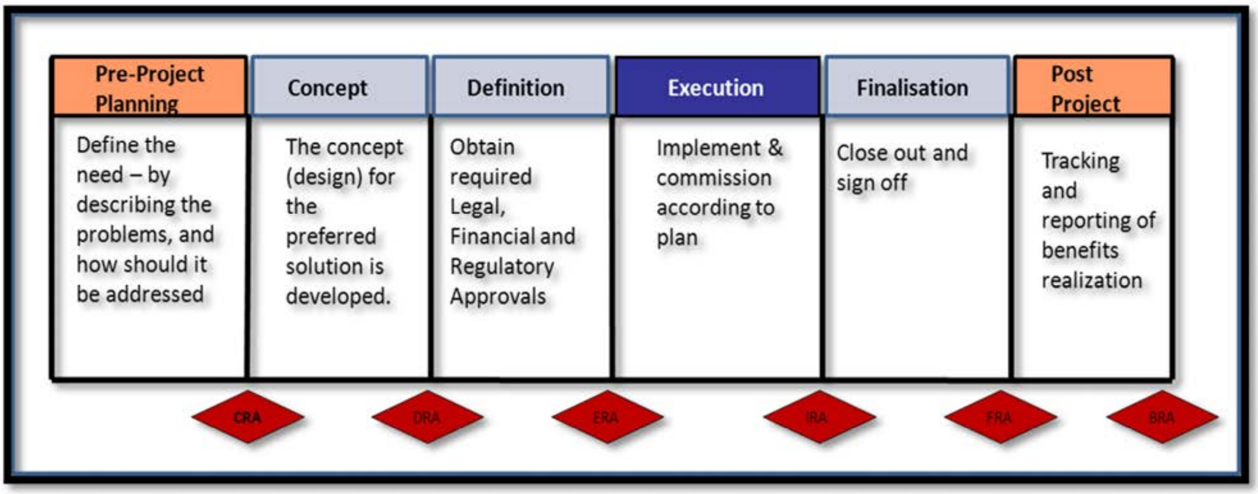


Figure 4-1: Simplified view of the project life cycle model (34)

The phase, stages and gates of the PLCM are defined as:

- **Phases;** A project phase is a section of a project life cycle, with logical activities. These phases ensure appropriate governance is in place to avoid risks in the process, by obtaining authority to proceed to the next phase.

- **Stages;** The Eskom reference PLCM uses the term ‘stage’ to refer to a subdivision of a phase. It defines specific objectives and deliverables for a particular subdivision. For the purposes of this study, the stages are also referred to as activities.

- **Gates;** A Stage Gate (or Decision Gate) is a pre-defined decision control point between phases and/or stages of the project, to reassess the effort in progress and to change or terminate the project if necessary. It is a mandatory decision control point requiring a management decision to authorise the project to proceed or to change the scope of work, or to terminate the project or a portion of the project. It provides management with a means to manage risk. Each gate has a specific function as seen in Table 4-1.

Table 4-1: Gate approvals

Phase	Gate	Approvals
Pre-Planning	Concept Release Approval - **CRA**	Senior Management
Concept	Definition Release Approval - **DRA**	Technical / Legal / NERSA
Definition	Execution Release Approval - **ERA**	Investment & Commercial Committee
Execution	Implementation Release Approval - **IRA**	Project Evaluation Committee (PEC)
Finalisation	Finalisation Release Approval - **FRA**	Sector Manager
Post project	Benefits Realisation Approval - **BRA**	Measurement and Verification

4.2. SYSTEM THINKING APPROACH

According to Dr. Julian Day, (33) when a situation becomes complex there are multiple perspective and divergent value systems and all are entirely legitimate. Table 4-2 summarises the framework and techniques developed by him for managing complex situations, for example the ESCO process; it goes on to explain the principle, technique applied and the process followed to determine high leverage interventions.

Table 4-2: Framework for managing complex situations (33)

No.	Principle	Technique	Process
1	Mind reading is unreliable and leads to unmanageability	Brain dump	Offload the problem and make the mess visible
2	If there was no variables in a problem then there would be no need for manages.	Cluster the problem into themes	Identify critical variables and name them well
3	A project is a system of interacting variables that must make sense and be manageable. Don't manage something that is not understood.	Interrelationship diagram (ID)	Understand variables interconnections
4	Managing the right things and expecting good outcomes	Scorecard (staircase)	Discover high leverage interventions
5	The purpose of a project is to add value to its stakeholders. Aligned expectations are crucial to project success.	Stakeholder value hierarchy	Discover what stakeholders value
6	Projects create new futures. Problems cannot be solved by using the same kind of thinking when the problem was created	Thinking outside the box	Surface and rethink limiting assumptions
7	Projects implement decisions to change something. The distinction between old and new must be sharp and clear	Stop/Start decisions	Design high leverage interventions
8	Represent the project outcome concretely to understand it. Make the project manageable	Rich pictures	Envision a concrete and compelling future state
9	Strong commitments drive project action not good intentions. Make commitments during conversations	Traffic light matrix	Establish a team and ensure team members make strong commitments
10	Transcend complexity through learning's. Learn to receive constructive feedback	Action learning	Reflect critically to make project improvements

4.3. APPLYING SYSTEMS THINKING APPROACH TO DETERMINE HIGH LEVERAGE INTERVENTIONS

The new process is designed using the technique shown in Table 4-2; steps 1 to 8 will be applied to determine high leverage interventions; thereafter the new process will be developed.

Steps 1 to 10 can be categorised as follows:

- **Steps 1 to 4** entail making sense of the problem.
- **Step 5 to 8** shows the thought process in becoming creative in looking for a new solution.
- **Steps 9 and 10** will be integrated into the development of the new process under section 4.4; hence it will not be explained in isolation.

• Step 1: Brain dump – (offload the story and make the problem visible)

In order to determine the activities in the pre-planning phase as per Figure 4-1, it is crucial to describe the problems within the current ESCO process. As indicated in chapter 2, the challenges with the ESCO process (23) (28) are:

There was insufficient staffing in the initial DSM group in Eskom and they could not cope adequately with the incoming workload. Proposals were often rejected as the proposal evaluation process was not well understood. EEDSM proposals were managed through an inefficient system which was not easy to use, time consuming and lacked transparency.

Clarity was needed on how to calculate MW savings outside peak times. The submissions from ESCOs often did not have the information required for a decision to be made. Frequent requests for more information had to be made with corresponding delays.

At times, due to the workload, the M&V teams could not go to site to conduct baseline measurements as planned. The cost of the M&V meters compared to project size could also be high. The commercial processes did not allow contracts to be negotiated in a simple, time efficient manner. The requests for discounts during negotiations led to delays. ESCO prices the project on benchmark values and could not understand why discounts should be provided. New requirements were implemented without the knowledge of the ESCOs.

The commercial process for EEDSM funding was lengthy and could take up to 15 months to complete. Eskom procurement had to evaluate the project in detail to determine whether the costs as submitted were in fact correct or if the ESCO was making a profit that was not in line with expectations. This took many months in some cases as the ESCO had to justify the costs in processes that Eskom staff had little or no expertise in. Thus it was very difficult for Eskom to decide on a cost to provide to the ESCO.

In addition, in many of the cases, the ESCOs had committed to a price that Eskom would pay to the customer and now had to go back to the customer with a revised price. This led to further delays. The DSM Agreement, which had to be signed between Eskom and the customer, is onerous and required in-depth discussions by lawyers of Eskom and the customer, therefore leading to more delays.

- **Step 2: Identifying critical variables and naming them well**

Having offloaded the problem in the form of an unstructured brain dump, the next step was to start making sense of the variables that need to be managed. The challenge was to synthesise a tighter understanding around these variables. This was achieved by looking for variables that have an affinity with each other and clustering them together to form themes. Each theme needs to be named in such a way that it accurately captures the meaning within the theme. Table 4-3 shows how an affinity diagram can be used to structure the problem.

Table 4-3: Affinity diagram (clustering the problems into themes)

Number	Cluster the problem into themes	Variables
1	Evaluation process not well understood, managed on an inefficient system, time consuming	**Streamlined process**
2	Insufficient staffing, could not cope with incoming work load	**Reduced burden on staff**
3	Due to turn around time of up to 18 months on the ESCO process, the market uptake for this model was slow	**Increased market uptake**
4	The commercial processes did not negotiate contracts in a simple, time efficient manner. The requests for discounts during negotiations led to delays. The ESCOs price the project on the benchmark values and could not understand why discounts should be provided. New requirements are implemented without the knowledge of the ESCOs.	**Commercial evaluation**
5	The DSM Agreement, which has to be signed between Eskom and the customer is onerous, leading to more delays as both the customer and Eskom legal teams need to vet.	**Contract simplification**
6	M&V teams could not go to site to conduct baseline measurements as planned. The cost of the M&V meters compared to project size could also be high.	**Measurement and verification**
7	Clarity was needed on how to calculate MW savings outside the peak times. The submissions from ESCOs often did not have the information required for a decision to be made. Frequent requests for more information had to be made with corresponding delays.	**Technical evaluation**
8	In many of the cases, the ESCO had committed to a price that Eskom would pay to the customer and now had to go back to the customer with a revised price.	**Pricing**

- **Step 3: Understanding variables by applying the Interrelationship Diagram (ID)**

To make sense of step 2, it is important to understand the interconnections between these variables. In general, stakeholders agree on the name of the variables; however the problem starts when stakeholders disagree on the state they would like the variable to be in. Therefore an interrelationship diagram as per Figure 4-2 was used to determine the interconnections between the variables. As per Figure 4-2 there are no dual arrows between variables, as the technique in this step calls for the arrows to go in one direction only, as two variables when compared with each other cannot be equally strong.

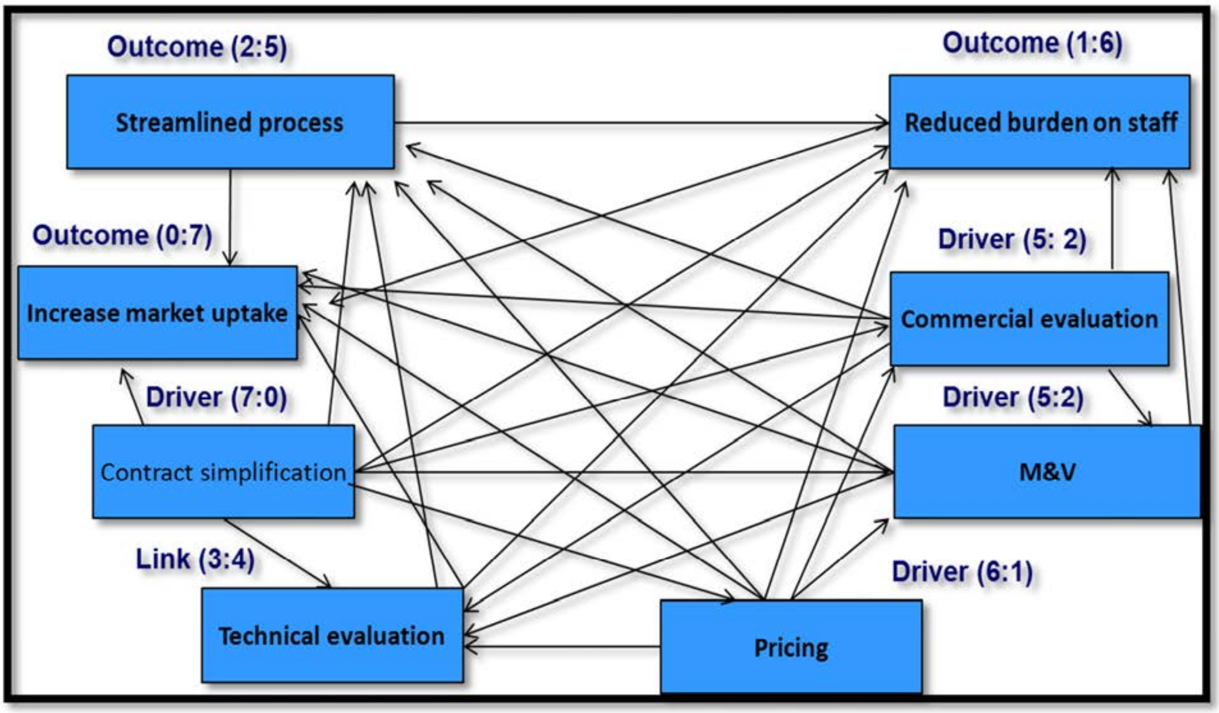


Figure 4-2: Interrelationship diagram

Figure 4-2 shows all the variables (as determined in step 2) placed closely to each other to determine the relationship and impact each variable has on each other. The variables are compared using the arrows. The "out:in ratio" example (2:5); (0:7), etc. is obtained by tallying the number of arrows pointing out of a variable versus the number of arrows pointing into a variable. This establishes the role of each variable, namely:

- ***Increased market uptake (0:7) –*** The ratio indicates that this variable is ***influenced*** by 7 other variables in the system as there are zero arrows leaving the variable and seven arrow flowing into the variable. Therefore it is massively impacted by 7 variables in the situation; hence this variable is known as the ***outcome***.

- ***Streamlined process (2:5)*** – The ratio indicates that this variable is ***influenced*** by 5 other variables in the system. It is massively impacted by 5 variables in the situation; hence this variable is also known as the ***<u>outcome</u>***.

- ***Reduced burden on staff (1:6)*** – The ratio indicates that this variable is ***influenced*** by 6 other variables in the system. It is massively impacted by 6 variables in the situation; hence this variable is also known as the ***outcome.***

- ***Contract simplification (7:0)*** – The ratio indicates this variable ***influences*** 7 other variables in the situation. It has a massive impact on the situation and for this reason it functions in the role of a ***driver.***

- ***Commercial evaluation (5:2)*** – The ratio indicates that this variable ***influences*** 5 other variables in the situation. It has a massive impact on the situation and for this reason it functions in the role of a ***driver.***

- ***Measurement and Verification (5:2) –*** The ratio indicates that this variable ***influences*** 5 other variables in the situation. It has a massive impact on the situation and for this reason it functions in the role of a ***driver.***

- ***Pricing (6:1) -*** The ratio indicates that this variable ***influences*** 6 other variables in the situation. It has a massive impact on the situation and for this reason it functions in the role of a ***driver.***

- ***Technical Evaluation (3:4) –*** The ratio indicates that this variable has a fairly even “out: in ratio” and does not function strongly as drivers or outcomes and can be called ***links.*** These variables do some influencing in the situation, but are also influenced by other variables in the situation.

- **Step 4 – Scorecard (staircase)**

Interrelationship diagrams can get complicated as seen in Figure 4-2; however they can be re-arranged for simplicity. Figure 4-3 shows how an interrelationship diagram can be rearranged into a scorecard that looks like a staircase. The stronger a variable functions in the role of a driver, the nearer it is positioned to the bottom of the staircase. The stronger a variable functions in the role of an outcome, the nearer it is positioned to the top of the staircase. Variables with even “out: in” ratios are placed in the middle of the staircase and links drivers to outcomes.

In order to climb a flight of stairs and reach the top step, it is necessary to start climbing from the bottom. It is futile to expect outcomes to be in a good state if drivers are mismanaged.

In Figure 4-3 it shows Eskom is spending extensive time on commercial evaluation, technical evaluation, and staff, however from the faces it can be seen that the state of these variables are sad, therefore it can be concluded these variables are being under managed to a certain extent.

The staircase can now be used as a scorecard. Working from the bottom up, we were able to assess how well we were managing the situation by determining the current state of each variable in the scorecard, and how much time we are currently spending on managing each variable in the scorecard. Based on this technique the SO team agreed all four drivers were in a bad state and needed to be fixed to achieve the desired outcome.

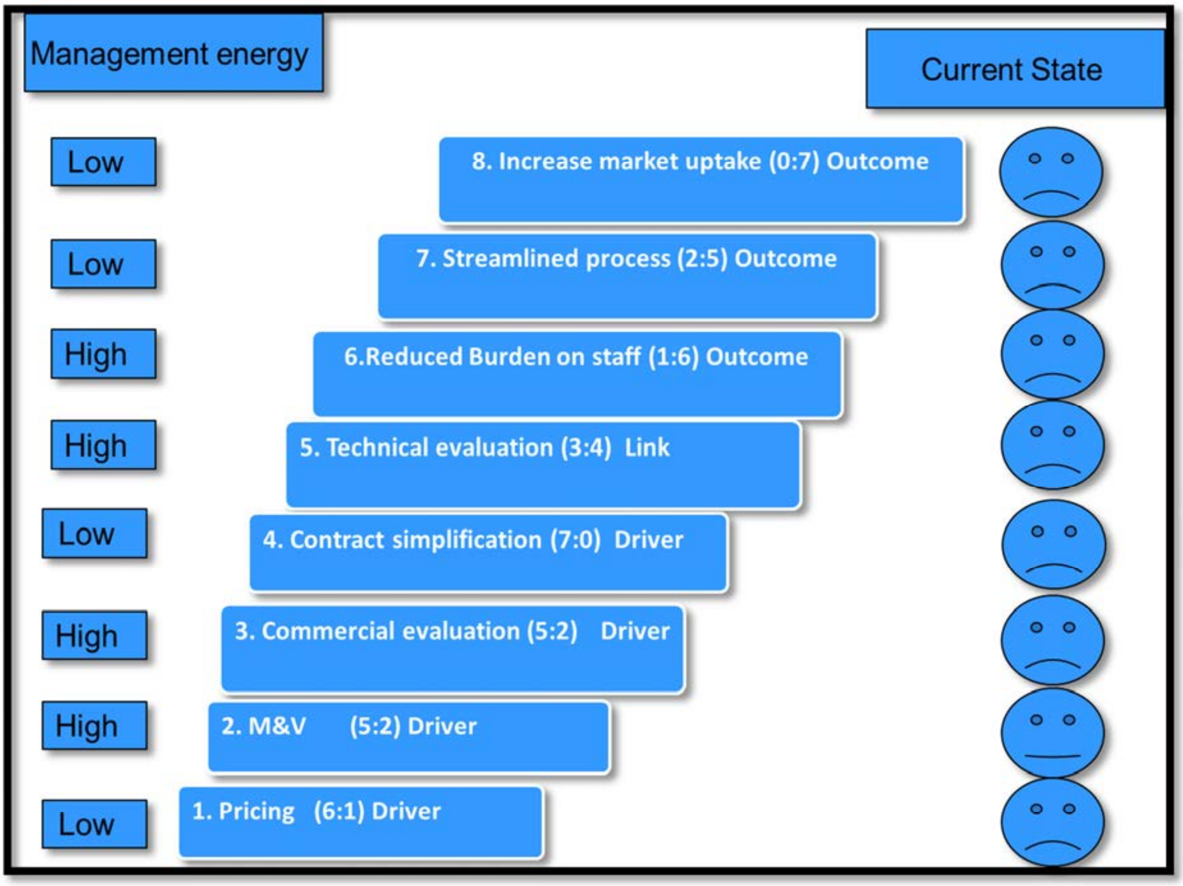


Figure 4-3: Systemic Scorecard

- **Step 5: Determining what stakeholders value**

The purpose of developing a new process is to add value to the stakeholders; hence it is important to discover who the stakeholders are and what they value.

5.1 Identifying key stakeholders in the SO process (31)

Primary stakeholders, that could impact Eskom's SO initiative are depicted in Figure 4-4, which is based on their individual impact as well as their direct involvement on the strategic level of SO initiative. SO initiative needs to be introduced and communicated to the targeted stakeholders.

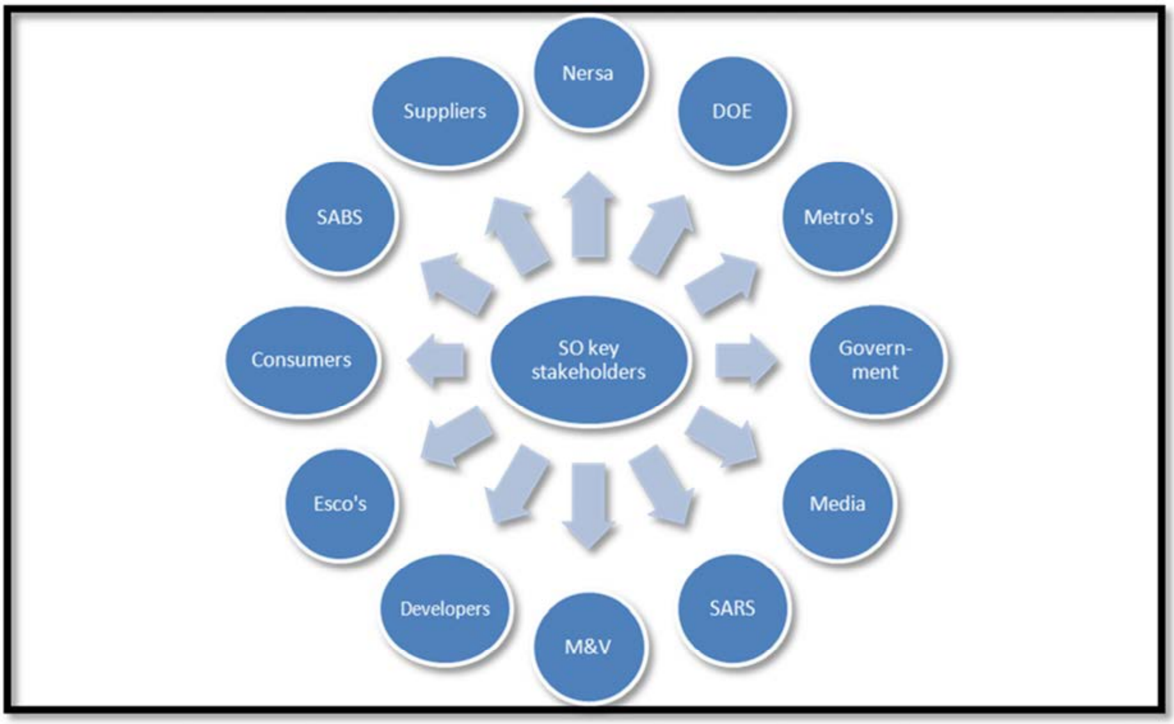


Figure 4-4: Key stakeholders to SO (31)

One of the key stakeholders in the SO process are the ESCOs. A workshop was arranged with them to discuss the proposed new process. The overall response from the ESCOs showed very keen interest in the new SO process and to some extent indicated they will be able to respond to the SO timeously.

5.2 Degree of stakeholder involvement

Figure 4-5 shows the degree of stakeholder involvement in the implementation of the SO process. From the stakeholder mapping exercise it can be seen that Eskom, ESCOs as well as M&V agencies score high on the implementation of the new initiative. Therefore, alignments of these stakeholders as well as the clear roles they are expected to play are critical to the successful implementation of the SO. Government departments such as DPE, DTI, DOE, and NERSA are envisaged to play an important policy and regulatory role in setting the landscape for the new programme.

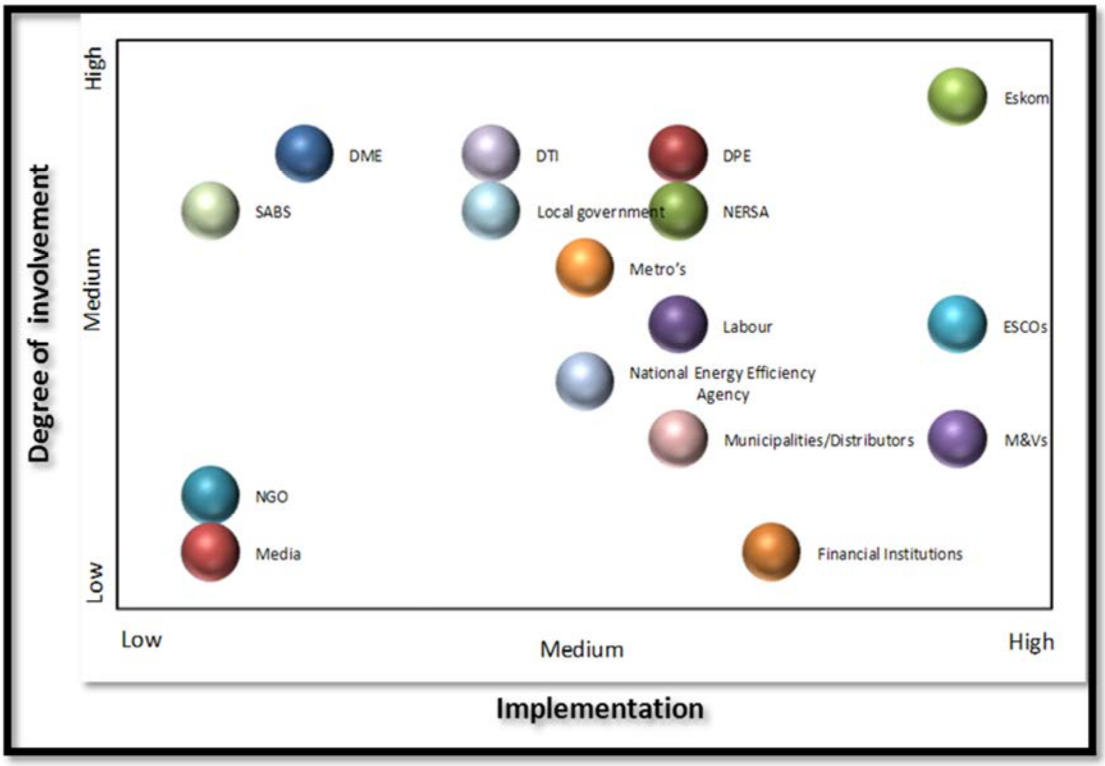


Figure 4-5: Degree of stakeholder involvement (31)

- **<u>Step 6: Surface and re-think limiting assumptions</u>**

Table 4-4 shows four current assumptions initially made in isolation regarding the status of the drivers. However after applying the technique of step six, interesting new thoughts on each assumption started to develop which helped to be creative in the design of the new process.

Table 4-4: **Rethinking limiting assumptions**

No.	Variables	Current assumptions	Interesting new thoughts
1	**Contract simplification Driver (7:0)**	• The Eskom legal department does not have time to simplify contracts. • It will take time for customers to understand the new contract.	• The legal department has appointed dedicated people to simplify contracts. • The customers are looking forward to a less onerous contract.
2	**Commercial evaluation (Driver (5:2)**	• The commercial department in Eskom does not understand what IDM's objectives are and therefore are not aligned. • The commercial department will not understand the concept of paying for energy as it does not fall under the goods and services category.	• The commercial department is equally frustrated with the slow process and is therefore looking forward to a process whereby risk and performance can be transferred to the PD. • In this way the need for discounts are not applicable.
3	**M&V Driver (5:2)**	• The M&V teams will not support the proposed SO process due to a deemed savings approach.	• M&V welcomed the idea of a new process, as it could mean that the PD will do their own measurements and the teams will do the verification of the measurements
4	**Pricing Driver (6:1)**	• The offer rate (c/kWh) to market needs to be sufficiently high for good uptake on EEDSM	• The market will accept a reasonable price, provided the existing process is streamlined.

- ## Step 7: Determine high leverage interventions

The next step is to determine high leverage interventions, which when focused on, will lead to maximum results. Based on step 3, high leverage interventions are also known as drivers. These drivers are:

- Contract simplification - Simplify the contracts between Eskom and Project Developer
- Commercial evaluation - Streamline the project approval process and scale-up projects
- Measurement and Verification – outsourcing the measurements
- Pricing – Provide PDs a pre-determined amount for delivered energy savings
- Technical evaluation (Link) - Provide transparency to PDs to calculate savings.

By focusing on these drivers a new process will evolve that will address the key objectives (outcomes) namely:

- Increased market uptake for Energy Efficiency.
- Streamlined approval process.
- Reduced burden on Eskom staff.
- Eskom's risk reduced by making the payments performance-based and pay only for measured and verified savings.

- **<u>Step 8 – Envision a concrete and compelling future state</u>**

It is envisaged that the SO approach, would allow Eskom to "purchase" energy savings from ESCOs and customers using a pre-determined and pre-published price. Implementation of this approach will streamline the process of evaluating project proposals and disbursing the incentives or subsidies, thereby reducing the burden on Eskom staff and facilitating a larger pipeline of projects.

4.4. DEVELOPMENT OF THE NEW SO PROCESS

In developing the new process steps, the immediate focus and attention was on the following ***driv*****ers** (high leverage interventions) as identified in steps 1 to 8 above:

- Contract simplification - Simplify the contracts between Eskom and Project Developer
- Commercial evaluation - Streamline the project approval process and scale-up projects
- Measurement and Verification – outsourcing the measurements
- Pricing – Provide PDs a predetermined rate in c/kWh in for delivered energy savings

- Technical evaluation (Link) - Provide transparency to PDs to calculate energy savings

By focusing on these drivers a new process will evolve that will address the key objectives ***(outcomes)*** namely:

- Increase market uptake for EE
- Streamlined approval process
- Reduced burden on Eskom staff
- Eskom's risk reduced by making the payments performance-based and pay only for measured and verified savings

Reflecting on the ESCO process, it was also found that the process activities were not well defined. The process in itself lacked controls and there were no clear roles and responsibilities of the parties involved. At the time the process was not aligned to the PLCM. Therefore in setting the **criteria** for the new SO process, it had to be ensured:

a) That the activity Process flows are well defined.
b) Critical controls for each activity are in place.
c) Roles and responsibilities (RACI) are documented for the Activities.
d) That the process is linked to Eskom's Project Life Cycle Model (PLCM), which is now policy in the company.

As per the PLCM discussed in the introduction of this chapter, the objective of the pre-planning phase is to define the needs of the new process and how it will be addressed. The concept phase entails the design of the new process. The definition phase entails the governance and regulatory approvals for the new process, followed by the execution phase; which is project implementation and commissioning as per the project plan. On completion the project can now be closed out and signed off by all parties involved - called the finalisation phase. The final step is the post project tracking, maintenance and performance monitoring to determine the benefits realisation.

The criteria also call for clear roles and responsibilities of the activities. The PLCM describes this as the RACI, which stands for Responsible (R), Accountable (A), Consulted (C), Informed (I).

The Accountable person is the individual who is ultimately answerable for the activity or decision. This includes “Yes” or “No” authority and veto power. This person has ownership of the outcome results of the decisions. The Responsible person is the individual who actually does the work and completes the activity. The Responsible person is responsible for implementation. Responsibility can be shared. The person that is consulted often has the opportunity to influence the decisions. More than one person can be consulted. The person that is informed is notified of the results or outcomes.

The benefits of applying the RACI help to identify process roles and activities that must be accomplished per activity; it also Increase productivity through clearly defined functional areas, key responsibilities, and decision points. It allows for transparency of the process.

The Critical Controls are controls whose effectiveness will contribute materially to the achievement of the Eskom strategic objectives and budgets or are required for contractual or regulatory compliance. Critical Controls are a critical component towards driving continuous improvement and in embedding a discipline of control consciousness into the business. Both senior management and auditors can often get assurance that the specified risk has not occurred, (or that the controls mitigating such risk has been effectively deployed), by monitoring a single critical control. This is typically a control that covers a range of risks or control objectives and is detective in nature. Where a critical control fails, management would look to evaluating the individual components of the standard controls to evaluate the extent to which the risk may or may not have been mitigated. If Critical control is not selected the control is automatically classified as a Standard control. Standard controls are the controls or a set of controls, (both detective and preventative) that will best achieve the control objectives for a specific process (35).

4.4.1 PRE - PLANNING PHASE

The pre-planning phase entails the mapping out of a new process flow and thereafter setting up a project team. Based on the STA (steps 1 to 8), the process criteria and the sequence of the PLCM, the new process flow as per Figure 4-6 from activity flow A1 to R was developed. The development steps in the new process will be discussed in detail in this section. Some activities will be explained in more detail as compared to other activities.

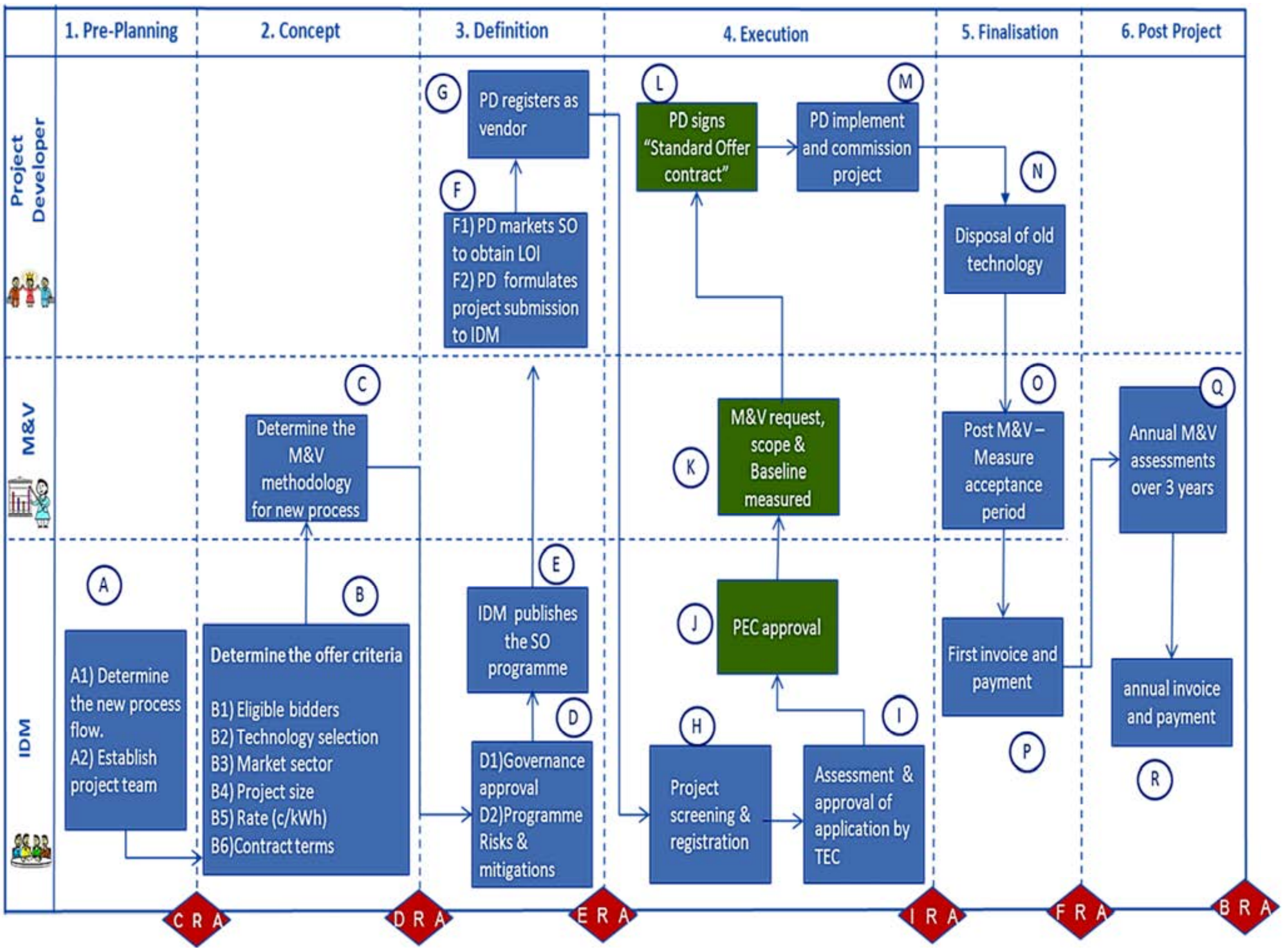


Figure 4-6: Development of the new SO process flow

- ***Activity flow A1***

a) ***Determine the new process flow***

This step addresses the thinking and criteria behind the new process flow from the pre-planning phase to the finalisation phase. In developing the new process, the aim is to streamline the current project approval process to the point that the SO contract is signed and executed. In developing the building blocks of the new process, it was necessary to comply with the process criteria and ensure the following outcomes were incorporated into the new process steps, namely;

- A shorter approval process however still remaining within the governance structure.
- The process is open and transparent.

- That administration of the SO is simple.
- That the PD knows the rate in c/kWh they would be paid upon successful delivery of monitored and verified savings.
- That a mandate for approval from the Procurement Tender Committee (PTC) is required for the delegation of authority for concluding agreements for the SOP.
- That this delegation will be vested in the PEC committee.
- PEC will evaluate the SO submissions technically and financially based on a pre-determined list of criteria to conclude individual contracts between Eskom and the PDs; hence no need for individual projects going to CIC and PTC.
- That payment to PD will be based on performance as per the SO performance contract; therefore no need to sign a New Engineering Contract (NEC) or DSM agreement.

With the above considered the different steps and logical flow of the new SO process were developed from Activity flow A1 to R as per Figure 4-6. These steps are also captured in Table 4-5 for ease of reading.

Table 4-5: SO process flow and activities for A1

Phase in the PLCM	Activity flows	Parties involved
1. Pre-planning	**A1** – Determine the new process flow **A2** – Establish project team	**Eskom – IDM**
2. Concept	Determine the following: **B1** – Eligible bidders **B2** – Technology selection **B3** – Market sector **B4** – Project size **B5** – Rate (c/kWh) **B6** – Contract terms	**Eskom - IDM**
	C – Determine the M&V methodology	**M&V**
3. Definition	**D1** – Governance approval **D2** – Programme risks and mitigations **E** – Publish the SO	**Eskom – IDM**
	F1 – PD markets SO to obtain LOI **F2** – PD formulates project submission to IDM **G** – PD registers as a vendor with Eskom	**PD**
4. Execution	**H** – Project screening and registration **I** – assessment and approval of application by TEC **J** – PEC approval	**Eskom - IDM**
	K – M&V request, scope and baseline measured	**M&V**
	L – PD signs SO contract	**PD**
	M – PD implements project	**PD**
5. Finalisation	**N** – Disposal of old technology **O** – Post Measure acceptance period **P** – Project sign off, submit invoice for payment	**PD**
6. Post project	**Q** - Annual M&V assessment over 3 year sustainability period	**M&V**
	R – Payment of invoice over 3 years	**Eskom - IDM**

b) **Determining the RACI**

In chapter 2, it was noted that the ESCO process lacked transparency. Both the ESCOs and PM did not fully understand who was accountable when and responsible for what, hence it was concluded that the ESCO process was managed inefficiently.

The purpose of developing a RACI for the new process is to assign clear accountability and responsibility to key role players involved in this activity. The RACI was developed for activity flow A1 in order to determine clear accountability, and responsibility as per Table 4-6.

Table 4-6: RACI to determine new process flow for A1

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
L. Padachi	IDM	M&V / NERSA	PMO / PD

c) Determining the critical control

The critical controls developed as per Figure 4-6 are to ensure the activities are approved at each phase by an authorised person or committee before the activity can progress to the next phase. As indicated in the introduction of this chapter, the critical controls are CRA/DRA/ERA/IRA/FRA/BRA approvals.

- ***Activity flow A2***

a) ***Establish project team***

Being appointed as the Project Leader, the author of this document was requested to establish a team to set the criteria for the initial SO pilot programme. Having applied the STA and mapping out the process, it was easy to identify the team members and their roles thereof. Figure 4-7 shows a programme structure of the team composition for the initial development of the SO pilot programme.

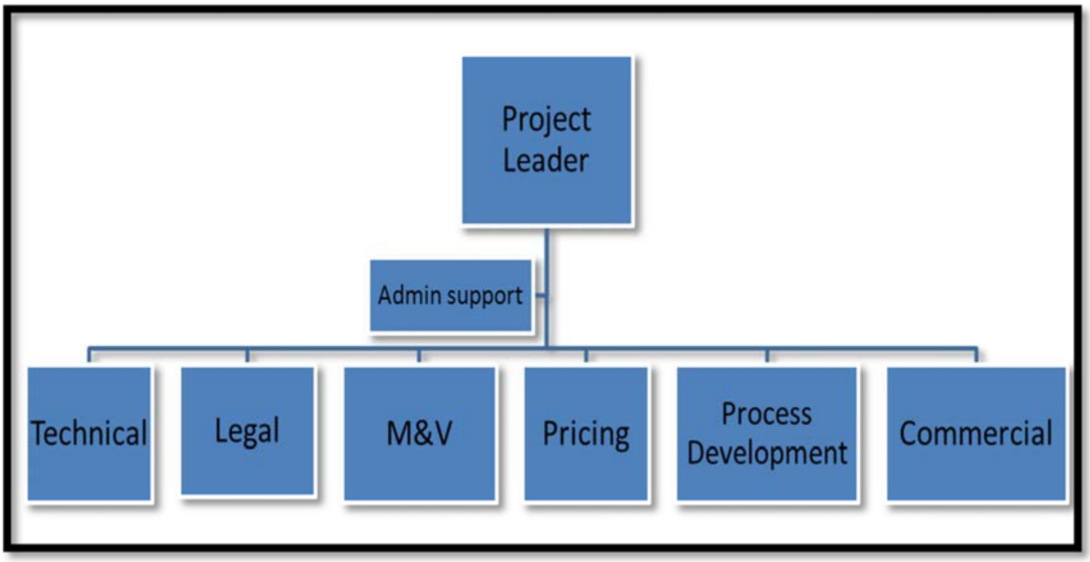


Figure 4-7: SO project team structure

As confidentiality of the project team members will be respected, the names of certain individuals will not be shown in the structure. The project team would be responsible for:

- Establishing the criteria of the SO programme – L. Padachi
- Developing the process flow and activities – L. Padachi
- Technical requirements of the SO programme – M. Ndlovu
- Developing the SO M&V protocols – M&V team member
- Developing the SO contract – Legal team member supported by L. Padachi
- Determining the SO price – Project team member supported by L. Padachi
- Seeking governance approval to streamline the commercial process – Commercial team member
- Publish the SO programme – Marketing team member

b) **Determining the RACI**

The development of the RACI was simple as each team member was informed of their role and key outputs. The team agreed that senior management would be informed as opposed to consulted on the process development.

Table 4-7: RACI for activity flow A2

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
Project team	IDM (L. Padachi)	M&V	Senior Management

c) **Determining the critical control**

The critical controls for activity A2 was to ensure team members sign a non- disclosure agreement for the duration of the programme development. The intention was not to create expectations to the market early in the process as some PDs would hold back project submissions instead of submitting via other funding models.

d) Applying the gate approval

Governance plays an important role in the successful development of the process. Therefore for the process to proceed to the concept phase, the preplanning phase has to be signed off. The work done in this phase, which includes identifying the process flow and developing the team, was then presented to the senior management committee for approval. At the time the committee did not fully understand the benefits of the new process and requested for a pilot to be performed. The committee thereafter approved the CRA gate, allowing the process to move to the Concept phase.

4.4.2 CONCEPT PHASE

The concept phase includes the development of the SO criteria. Following approval of the CRA gate, the SO criteria were developed; this includes the determination of eligible bidders, technology selection, targeted market sector, project size, offer rates and contract terms.

- ***Activity flow B1***

a) **Determining eligible bidders**

It was shown in the ESCO process that only registered ESCOs could submit projects to Eskom for funding consideration; this resulted in a poor pipeline of projects for IDM'S approval. For greater market uptake the SO process should allow for broader market participation, hence the team allowed the following types of organisations called “Project Developers” (PDs) to provide proposals to Eskom under the Program – this is also aligned to international best practice.

- Any customer of Eskom or municipal electricity providers in the commercial and industrial sectors; and
- Energy service company (ESCO), defined as a business entity that provides any or all of the following services: energy engineering, energy efficiency design, equipment installation, equipment maintenance and financing services on a performance contracting basis.

The rationale behind not only allowing ESCOs to bid is that many large organisations have the competency, capacity and resources to undertake their own energy efficiency programmes and they should therefore be eligible to partake in the program.

Furthermore, by including other organisations other than ESCOs, including Large Power Users (LPUs), the intention is to increase the pipeline of projects undertaken and the potential to deliver a significant amount of MWs within a short period of time.

b) Critical control

In this step it is mandatory for the PD to sign an agreement with the energy consumer or facility owner to transfer ownership of verified energy savings from the energy consumer or facility owner to the PD. The intent of this is to avoid potential disputes between the facility owner and PD if the project underperforms during the measure acceptance period (MAP).

- ***<u>Activity flow B2</u>***

a) **Technology selection**

The purpose of this activity is to publish a list of approved technologies that are eligible for consideration under the SOP. In the past ESCOs would often submit projects with technologies that were not tested nor approved, which resulted in high failure rates at customers’ facilities.

In selecting the technology the team agreed there were two main types of technologies for consideration; pre-approved and have been successful implemented via the ESCO model and unknown or not pre-approved. It was decided, only pre-approved technologies should immediately be considered for the program within the first year as the aim of the program was for rapid deployment.

Unapproved or unknown technologies have to go through a process to become approved and will only be eligible for long-term considerations within the SOP. The current technologies that have been deemed to be part of the SOP:

- Energy efficient lighting and HVAC systems
- Building management systems (BMS)
- Electrical hot water systems
- Process Optimisation systems including pumps, motors, compressed air etc.
- Solar water heaters
- Light Emitting Diodes (LED) down lighters
- Renewable energy (Photo Voltaic cells)

b) **Critical controls**

As per the technical manager's recommendation, for a product to be considered part of the SOP, compliance with Eskom's minimum technical specification is required. In addition, the following is required as a basis of the technical evaluation of proposed products:

- Technical data specification sheet;
- Letter of Authority (LOA), where applicable; and
- Valid test reports by an independently recognised test laboratory based on SANS/IEC testing standards.

- ***Activity flow B3***

a) **Determining the market sector for SO implementation**

The decision to develop the SO for the commercial and industrial sectors was based on the energy consumption patterns of these sectors. A typical weekday profile for a commercial and industrial customer in SA can be seen in Figure 4-8. From these profiles it can be seen that both industrial and commercial sectors consume a substantial amount of energy between the core hours of 6.00 am to 10.00 pm. Therefore eligible energy efficiency measures on the new programme must reduce electric energy consumption at the project site between 6.00 am to 10.00 pm, Monday to Friday in order to cater for both sectors.

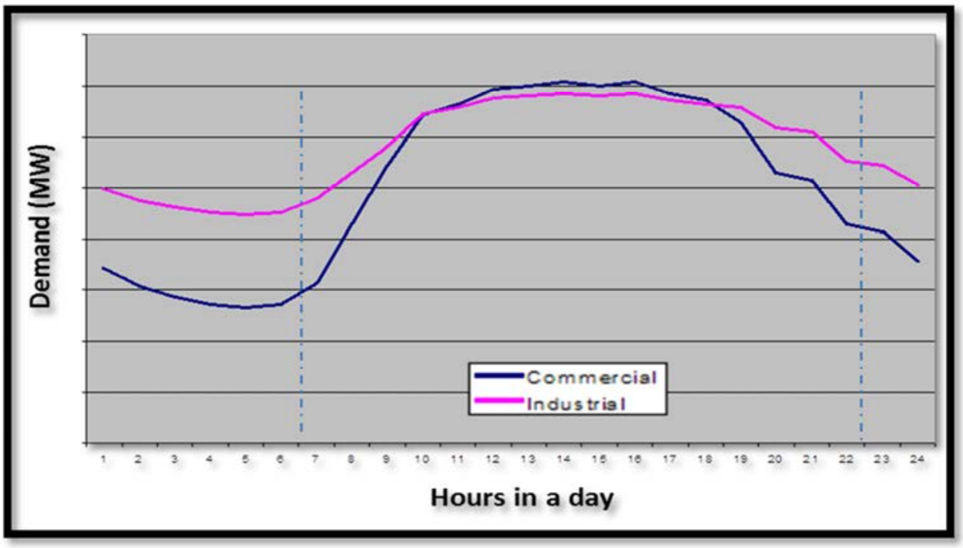


Figure 4-8: Industrial and Commercial electricity consumption patterns in SA

b) **Critical controls**

The critical control in developing this activity is to ensure energy savings achieved before 6.00 am and after 10.00 pm on weekdays and on weekends will not be considered towards payment for energy reduction as these hours are outside the Eskom peak times. Currently there is adequate capacity to supply SA outside of peak times.

- ***Activity flow B4***

a) **Setting the project size**

The eligible project sizes have been set between 50 kW and 5 MW limits. The development of the lower boundary limit has been imposed so as not to constrain the system with many small projects, which could lead to an administrative burden on staff. With respect to the development of the upper limit, projects may not be greater than 5MW in order to limit the PD exposure to financial and technical risks.

b) **Critical controls**

The critical control in developing this activity is to ensure projects below 50 kW and over 5 MW are not passed through the system for approval. By failing to comply the PM could be accountable for wasteful expenditure.

- **Activity flow B5**

a) **Determining the SO rate**

The development of the SO rate is based on the NERSA approved benchmark of R5.25 million for every one MW saved over a sustainability period of 5 years (9). In calculating the offer, the following principles were used to convert R 5.25m/MW into an energy rate in c/kWh:

The SO focuses on energy savings between 6.00 am and 10.00 pm (16hrs/day), weekdays only, with contract duration of three years, using this information the equation was applied as follows:

- Energy (MWh) = Power (MW) * (8760 X LF)…………….......equation 1
- Cost (R/MW) = Energy (MWh) * rate (c/MWh)…………….equation 2

Calculating the Load factor (LF) refers:

- Load reduction duration from 6.00 am to 10.00 pm = 16hrs/day
- 16hrs/day x 5 days (Monday to Friday) = 80hrs/week
- 80hrs/week x 52 week/year = 4160 hours/pa
- There are 8760hrs/pa

Hence the LF = 4160hrs/8760hrs = 47.5%. (This is in line with the constraint periods in SA)

- Therefore Energy (MWh) = 1 MW X 8760 x 47.5% = 4160MWh/pa (as per equation 1)

By applying equation 2, the rate is calculated as follows:

- Rate (c/kWh) = Cost (R/MW) / MWh

  = 5.25/4160 X 1000

  = R 1.26/kWh

- The sustainability period for SO is 3 years, therefore R1.26/kWh divided by 3 years = 42c/kWh per annum.

- ***Activity flow B6***

a) Developing the SO contract terms

The challenges experienced with the ESCO process regarding the NEC contract and DSM agreement, has prompted the need for a new contracting mechanism with PD. The legal team member from Eskom led this activity and with the teams input, it was decided the principles and conditions of the SO contract should be:

- Performance based – pay PDs for measured and verified savings.
- Transfer risk to the PDs – implementation and performance risk is transferred to the PD; hence no need to use the conditions of the NEC contract, thereby completely eliminating the need for the NEC.
- Sustainability period – spread the balance of the performance payment over three years, thereby eliminating the need for the DSM agreement.
- Transfer liability to the PD – Eskom will not undertake any liability regarding the skills and expertise of the PD; neither will Eskom guarantee the approved technology will achieve the desired energy savings. The PD must also indemnify Eskom against all damages suffered if any.

- Insurance – the PD must take out its own insurance during the implementation of the project and sustainability period.
- Laws and Regulations – the PD must ensure that the approved technology complies with all laws and regulations related to the installation at the facility.
- Maintenance – the PD is responsible to maintain and repair the approved technology for three years.

The principles were agreed with the team and thereafter the SO contract was developed making provisions for baseline development, payment terms, and obligations of the parties, indemnities, guarantees, dispute resolutions, breach and termination of contract.

b) **Critical control**

The SO contract must be signed by both IDM and the PD before the project can be implemented, failing in which the PD will not be compensated for work done.

- ***Activity flow B7***

c) Developing the SO payment terms

One of the challenges experienced with the ESCO process was the NEC contract payment terms. The NEC is designed to penalise the ESCO for underperformance and there are no rewards for over performance. The NEC penalties do not encourage over performance on projects.

In developing the SO payment terms, cognisance had to be taken of the ESCO challenge as well as the principles used in developing the SO contract, namely:

- Reduce Eskom's risk by making the payments performance-based and pay only for measured and verified savings - no energy savings achieved, equals no payment to the PD.
- Eliminate the need for using the NEC contract terms and conditions, as the implementation and performance risk is transferred to the PD.
- The payment is spread over a period of three years, called the sustainability period, therefore eliminating the need for a DSM agreement.

Considering the above and in view of the fact that the PD carries the financial risk for underperformance, it was decided to financially reward the PD for an over performance of 10%.

The SO team also decided the first payment to the PD would only be made after verification of performance by M&V called the Measure Acceptance Date (MAD). Initial thinking was to pay 60% of the contract value to the PD on MAD, and thereafter release 40% over the sustainability period of 3 years.

The market was consulted. There was poor support for the payment terms proposed. Potential PDs indicated they will not be able to cope financially if 40% of the contract value is paid over 3 years. Considering the concerns raised and that the risks are carried by the PD, it was agreed to change the payment terms to release 70% of the contract value on MAD and 30% over the sustainability period of 3 years.

The SO contract value is calculated as follows:

Contract value = (kW savings x 4160hrs/pa) X (rate x sustainability period)…..equation 3

To ensure the sustainability of the verified energy savings after MAD, retention of 30% will be held by IDM. This retention will be paid over the sustainability period of 3 years. The first performance payment (10%) based on the verified savings by M&V will be made 12 months from MAD. The second performance payment (10%) will be made 24 months from MAD. The third performance payment (10%) will be made 36 months from MAD.

a) **Determining the RACI**

Based on this activity B1 –B7 the RACI was developed as per Table 4-8.

Table 4-8: RACI for activity flow B1-B7

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
IDM	SO project team	Finance /NERSA	PD

b) **Determining critical controls**

The PM must ensure that the sum of all payments to the PD must not exceed the SO contract value plus 10% allocation for over performance. To enhance this control it was requested that the finance department lock in the SO contract value on the finance payment system.

- **Activity flow C**

a) **Determining the M&V methodology**

The M&V team member advised that the same M&V protocols and standards namely SATS50010 will be used in the SO approach as used in the ESCO process; while at the same time allowing for it to be more flexible and streamlined in the spirit of the programme, in order to accelerate energy savings opportunities. A general M&V guideline was developed for the SO process.

To highlight, the M&V steps for the SO process are:

- Eskom will appoint M&V body to generate the M&V plan
- PD will purchase and install measuring equipment
- Baseline developed by the M&V body
- Project implemented by the PD
- Certification of completion (COC) produced
- Post Implementation report and verification of COC
- Conduct Performance assessment 1
- Continue Performance assessment in year 2,3 and 4

b) **Critical controls**

The PD cannot start project implementation if the project baseline is not accepted and signed off by M&V/ IDM and the PD.

c) **Determining the RACI**

Based on the M&V requirements the RACI was developed accordingly for activity flow C as per Table 4-9.

Table 4-9: RACI for activity flow C

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
M&V	M&V	IDM	PD

d) Applying the gate control

Governance plays an important role in the successful development of the process, therefore for the process to proceed to the definition phase; the concept phase has to be approved. The work done on this phase was presented to the technical evaluation committee and the legal department for consideration and approval. The committees approved the DRA gate and allowed the process to continue to the next phase; being the definition phase.

4.4.3 DEFINITION PHASE

It was acknowledged that the commercial process to evaluate ESCO projects was lengthy and could take up to 15 months, (or longer in some cases) to complete. Eskom procurement had to evaluate each individual project in detail to determine whether the costs as submitted, were in fact correct or if the ESCO was making a profit not in line with expectations.

❖ **Activity flow D1**

a) ***Governance approval***

To overcome the challenge experienced in the commercial process, a Standard Offer, (blanket strategy) approach was requested to shorten the process, but to remain within the governance structure. The intention is to enter into various SO contracts for individual projects. This will allow IDM to manage a group of projects with the same conditions and not to present individual projects each time to the investment and procurement committees.

In order to make the new process a reality and overcome the challenges experienced in the commercial process, bulk approval of funds from the investment committee and a mandate from the procurement committee was urgently needed.

Therefore a request was made to the Investment committee seeking approval for the following:

- To implement the IDM Standard Offer (pilot) Commercial and Contracting Strategy for Energy Efficient Savings up to a maximum total budget value not exceeding R 30 000 000, excluding Value Added Tax (VAT) for the total combined contracts for a period of 36 months. The savings expressed in kW and kWh, with the related costs distribution over the sustainability period, were also submitted to the investment committee as shown in Table 4-10.

Table 4-10: Summary of SO parameters

Design Parameters							Payment spread over 3 years		
Project size	kW savings	hours P/A	kWh/PA	Rate 42 c/kWh	Contract value	Measure Acceptance Date (70%)	Performance payment Year 1 (10%)	Performance payment Year 2 (10%)	Performance payment Year 3 (10%)
MIN	50	4160	208,000.00	0.42	R 262,080	R 183,456	R 26,208	R 26,208	R 26,208
	100	4160	416,000.00	0.42	R 524,160	R 366,912	R 52,416	R 52,416	R 52,416
	150	4160	624,000.00	0.42	R 786,240	R 550,368	R 78,624	R 78,624	R 78,624
	200	4160	832,000.00	0.42	R 1,048,320	R 733,824	R 104,832	R 104,832	R 104,832
	500	4160	2,080,000.00	0.42	R 2,620,800	R 1,834,560	R 262,080	R 262,080	R 262,080
MAX	5000	4160	20,800,000.00	0.42	R 26,208,000	R 18,345,600	R 2,620,800	R 2,620,800	R 2,620,800

Based on the submission, the investment committee as a minimum calculated the financial implications and proposed benefits to Eskom. The net present value, internal rate of return, and payback periods were calculated and thereafter the committee agreed to allocate a budget to the programme.

Following on from the Investment approval a request to the Procurement Tender Committee (PTC) was made for approval:

- That the PEC be granted a mandated to conclude contracts with compliant PDs for a maximum contract period of 36 months.
- The rate in (c/kWh) for energy savings will be fixed per technology group.
- An initial payment of 70% of the anticipated total savings in respect of each particular contract is made after commissioning and the verification of savings and the outstanding balance paid thereafter at a rate of three payments of 10% each per year, for three years, with adjustments made to the final payments to compensate for any anticipated savings not achieved.
- That the pro forma contract, compiled by the Legal department is approved as standard documentation for the enablement of contracting with potential PDs.

- That the Senior General Manager (SGM) of IDM be authorised to delegate further, to take all necessary steps to give effect to the above, including the signing of any agreements, consents or other documentation necessary or related thereto.

- Only pre-approved technologies be accepted to participate in the SO programme

- PDs be appointed as per Eskom vendor registration process.

- Savings be verified by an independent measurement and verification (M&V) organisation before any payments are made to the PD.

The committee reviewed the submission and further requested for a comparison to be shown between the current ESCO process and the proposed SO process in terms of the tendering method followed, determination of the contract price, channels to market, payment terms, etc. The comparison was done as shown in Table 4-11. Upon which the committee granted approval.

Table 4-11: Governance comparison between the ESCO and SO process

No.	Governance steps	ESCO process	SO process
1	**Request for projects (Tender or non-tender process)**	• No tender – submission based on ESCO intellectual property. • Approval based on a first come first serve basis.	• No Tender – Submission based on predefined standard price and technology.
2	**Contract price**	• Negotiated – discounts requested	• Not negotiated – fixed rates
3	**Contract data & conditions of contract**	• Negotiated – depending on project risks	• Not negotiated – As per standard legal contract terms and conditions
4	**Channels to market**	• Expression of interest evaluated on a "first come- first serve" basis subject to the approval process.	• Expression of interest evaluated on a "first come- first serve" basis subject to the approval process.
5	**Approval time**	• Turn-around time 6 mths to 18 mths	• <1 mth
6	**Payment terms**	• Payment upfront (implementation milestones)	• Retrospective performance based payments
7	**Finance**	• Eskom takes financial and performance risk (mitigated by penalty clause in NEC and DSM agreement)	• Developer takes financial and performance risk.
8	**Risk**	• Potential risk to Eskom owing to upfront payment	• Minimal risk – payment based on performance.
9	**Sustainability**	• Sustainability governed by DSM agreement	• Sustainability governed by performance based payment.

❖ **Activity flow D2**

a) **Risks and mitigations**

In every new process risks and mitigations have to be identified upfront. This is a key step for ERA gate approval. Table 4-12 summarises the new process risks and mitigations per category as identified by the SO team.

Table 4-12: SO process risks and mitigations

Category	Risk Description	Mitigation Strategies
Contractually	Unfair dealings and preferential treatment may have a negative influence on credibility of the SO Programme.	One of the great strengths of this program is that the offer will be made available to the general marketplace. The process is open, transparent and should dispel fears of preferential treatment.
M&V	M&V capacity may negatively affect the operations of the SOP.	Allow the PD to purchase metering equipment to determine M&V plan, which must be verified by the M&V body.
Financial outlays	PD may not take up the SOP due to lack of external finance to enable them to fund the project.	By issuing the SO contract upfront prior to implementation should enable PD to secure funding. Furthermore, 70% of the contract cost will be paid on commissioning and verification of the project.
Pricing and incentives	Pricing and incentives may be inadequate.	Market uptake will be monitored to determine an adequate pricing level with-in the limits of average NERSA benchmarks.
Sustainability	Sustainability of the energy savings may not be achieved, resulting in loss of long-term energy savings.	No energy savings equals no payment by Eskom, hence a retention of 30% is held by IDM, and will be paid out over the 3 years sustainability period.
Process	Procedural issues may impede the speed of the market response, which may negatively affect the SOP market uptake.	Transparent and streamlined process will enhance the uptake of the programme.
Technology failure	Failure of the implemented technology in the sustainability phase.	PD must insure the Approved Technology for the duration of the Sustainability Period,

b) **Determining the RACI**

The RACI was developed for activity flow D1 and 2 as per Table 4-13.

Table 4-13: RACI for activity flow D1 and 2

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
IDM	Commercial & Finance	N/A	Legal department

c) **Critical controls**

The PEC has now been granted a mandate to conclude contracts with compliant PDs; this mandate must be respected and strictly adhered to, as the committee is authorised to conduct technical, financial and commercial approvals. In the ESCO process, PEC was authorised to conduct technical approvals only.

❖ **<u>Activity flow E</u>**

a) Publishing the SO

On completion of steps A to D, the marketing department under the leadership of the marketing team member was requested to publish the SO programme nationally. The intention of publishing the SOP nationally is to achieve greater market uptake for EEDSM. To apply for funding under the SOP, the Project Developer has to follow the application process steps from activity flow F to R as per Figure 4-6.

b) **Determining the RACI**

The RACI was developed for activity flow E as per Table 4-14

Table 4-14: RACI for activity flow E

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
IDM	Marketing department	M&V	PD/Customers/Public

c) **Determining Critical controls**

Information on the SO programme must not be shared with the market prior to the official publishing of the offer to the public, as it could be perceived that certain PDs will have a competitive advantage.

❖ **Activity flow F1 *(Start of the SO application process)***

a) PD markets SO to obtain LOI from Customers

It was mentioned in Chapter 2, that ESCOs find it difficult to sell the ESCO process to customers to obtain a LOI. The reason being the ESCO programme rules are not well defined, nor transparent. Time taken to obtain a LOI from a customer could be as long as 3 months.

In developing activity F1, steps similar to the ESCO process were followed; with the difference being the new SO process rules are well defined and very transparent.

This step entails the PD marketing the SO programme to potential customers to participate in the programme. Where a customer opts to partner with a PD to act on their behalf, the customer is required to sign a letter of intent to confirm this agreement for the entire contract period. The SO contract will thus be placed between IDM and the Project Developer.

b) **Determining the RACI**

Based on the activity outcomes, The RACI was developed as per Table 4-15.

Table 4-15: RACI for activity flow F1

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
PD	PD	Customer	IDM

c) **Determining the critical Controls**

The critical control in this step is to ensure that the LOI is signed between the PD and the customer/ The LOI allows the PD to claim ownership of the verified energy savings after project execution from the customer. If the LOI is not signed, the PD could be exposed to performance risk at a later stage; as payment for verified energy savings are made to the PD and not the customer.

d) Suggested time to obtain LOI

As this activity requires extensive marketing and follow-ups to the customer; the suggested time to complete this activity is set at 3 weeks in the new SO process.

❖ Activity flow F2

a) PD formulates project submission to IDM

It was mentioned in Chapter 2, that ESCOs allocate time and funding to investigate projects that may eventually not even be funded by Eskom due to incorrect technical information provided. This is frustrating for the ESCO, as it takes time to develop a project.

To overcome this challenge, the technical team was instructed to develop project submission templates to ensure that correct information is supplied by the PD. The templates must be shared with the PD upfront, thereby ensuring greater transparency of requirements.

This step is used to gather information on the project where the PD will become familiar with the SO requirements. The PD must gather the following information:

- PD Details and background
- Project Site Information
- Project Summary and background
- Customer background
- Project Scope of work
- Energy savings calculations
- Load profiles
- Project finance
- Project risks
- Environmental issues

Determining the RACI

Based on the activity outcomes, The RACI was developed as per Table 4-16.

Table 4-16: RACI for activity flow F2

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
PD	PD	Customer	IDM

b) Critical controls

The critical control in developing this process is to ensure the PD complies with all the information requested on the project submission template, after which the project proposal must be signed off by the customer before the project is submitted to IDM. Past experience with the ESCO process, shows customers often did not see the final project submission made to IDM.

c) **Suggested time to formulate project submission**

The suggested time to complete this activity is set at 4 weeks in the new process. This will allow sufficient time for the PD to gather the necessary information to formulate the project.

❖ **<u>Activity flow G</u>**

a) PD registers as a vendor

This step is similar to the ESCO process step and involves the evaluation and registration of the PD as a vendor to do business with Eskom. This step is a gate keeper, and failing to register as a vendor will prevent the PD from doing business with Eskom or receiving payments.

Knowing this upfront, the PD must comply with all the requirements of the vendor process as per Table 4-17, to ensure the company will be registered with Eskom.

Table 4-17: Vendor registration process

Requirements	Description
1	Original cancelled cheque or letter from the bank, verifying banking details
2	Certified copy of business registration documents of company
3	Tax clearance certificate
4	Proof of registration with UIF
5	Proof of registration with compensation fund for workers
6	A copy of the CIDB (Construction Industry Development Board) certificate
7	Proof of professional registration
8	Shareholder certificates or the shareholder's agreement
9	Confirming the percentage of Black ownership and Black management within the business
10	Latest verified annual financial statement confirming annual turnover, Net Profit Before Tax (NPBT) and total cost of labour
11	Letter signed off by an auditor or certified accounting officer confirming the entity is newly incorporated and is in its first year of operation

b) **Determining the RACI**

Based on the vendor registration requirements, The RACI was developed for this activity as per Table 4-18.

Table 4-18: RACI for activity flow G

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
IDM	Eskom vendor management department	PD	PM

c) **Determining the critical controls**

The critical control in this activity is to ensure the PD complies with the requirements of the vendor registration process. Non-compliance will lead to extensive delays in the registration process, causing frustration to both the PD and Eskom.

d) **Suggested time to register a PD as vendor**

The suggested time to register a PD as a vendor is set at 2 weeks provided all the vendor requirements are met.

4.4.5 EXECUTION PHASE

❖ **Activity flow H**

a) Project screening and registration

Based on the challenges with the ESCO model process, projects submitted to IDM were often not registered as they were not well understood by the PM. Therefore this step was developed to ensure proper controls and templates are in place for the PM to better understand the project and requirements thereof.

Furthermore every project must be registered by the PM to ensure effective tracking of the project from a time, cost and quality point of view. PDs also requested some form of project identification as they often worked on multiple projects at the same site.

This step involves the screening and registration of the project by the PM as per the newly developed registration template by the technical team. The new template as seen in Table 4-19 is self-explanatory and therefore directs the project manager to look for specific fields in the project submission.

Table 4-19: Screening and registration template

No.	Screening fields	To be completed by PM
1	Project Number	
2	*Project Name	
3	Customer Name	
4	*IDM Sector	
5	*Technology	
6	*Group Customer Service Areas	
7	*IDM Regional	
8	*National Province	
9	ESCo (if applicable)	
10	Project Developer Name	
11	PD Contact Number	
12	Letter of Intent provided?	Yes / No / Not Applicable
13	*Project Manager/Energy Advisor	
14	*Proposed Demand Savings	
15	Technical Load Factor	
16	*Proposed Energy Saving	
17	*IDM Funding Category (Please select)	Standard Product / **Standard Offer** / Performance contracting / ESCO
18	*Maximum Project Cost to Eskom	
19	*Time to Implement (in months)	
20	Project Status (Please select)	
21	*Proposed Start Date	
22	*Proposed End Date	
23	M&V Request submitted (if applicable)	
24	When is it anticipated that the project will be claimed (Please Select)	

b) **Determining Critical control**

* Denotes Compulsory information required by the Programme Management Office (PMO); if not completed this project will be rejected and will not be registered on the (PMO) database.

c) **Determining the RACI**

Based on the activity outcome, the RACI was developed for this activity as per Table 4-20.

Table 4-20: RACI for activity flow H

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
IDM	PM	PD	PMO

d) **Suggested time to screen and register a project**

As this activity requires the gathering of information, the suggested time for the PM to complete this activity is set at 1 week.

❖ **Activity flow I**

a) TEC evaluation

This step is similar to the ESCO process step, whereby the PM submits the project to a Technical Evaluation Committee (TEC). TEC will assess the technical soundness and viability of the submission before it can be presented to the Project Evaluation Committee (PEC) for approval.

The challenges experienced with this step in the ESCO process was the requirements for TEC evaluation not being well understood. It lacked transparency, hence projects were often rejected.

To overcome these challenges the technical department developed a project checklist (Annexure A) that was transparent and entailed all the requirements of the committee. The checklist covered five main parts, which the PM must comply with, namely:

Part A: General project information

Part B: Technical information

Part C: Requirements for specific technologies

Part D: Information required for PEC submission

Part E: M&V

Together with the checklist, the PM has to also submit the following information to the TEC for approval.

- Project scope of work
- Technology overview
- Load profiles
- Load reduction calculations

b) **Determining the RACI**

Based on the activity flow, the RACI was developed for this activity as per Table 4-21.

Table 4-21: RACI for activity flow I

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
PM	TEC	PD	PMO

c) Determining the Critical controls

The PM also has to comply with the requirements of TEC by completing the standard checklist developed by the technical team for the SO programme as per annexure A. The checklist was developed to ensure transparency of TEC requirements. These requirements will direct both the PD and PM to submit necessary information to TEC for evaluation. The enhanced checklist prompts the PM to make sure the submission is all inclusive.

d) **Suggested time for TEC approval**

Based on the level of detail required from TEC upfront, an approval time of two weeks was set for a project to be approved at TEC.

❖ Activity flow J

a) **PEC approval**

Based on the approval of step D, the PEC committee received a new mandate that will enable the committee members to approve a SO project from a technical, financial and commercial point of view.

Previously in the ESCO process, the PEC only had a mandate to approve the technical part of the project, thereafter recommending the project to the financial and commercial committees respectively, which led to unnecessary project delays.

Due to the urgency and need for EE projects the PEC committee chairman decided to have a committee meeting once a week to speed up the evaluation process.

The committee requested the following documents be submitted in order for the committee to make an informed decision:

- The project registration form completed by the PM
- TEC checklist completed by the PM
- Overview of the project risks and possible mitigations

b) **Determining the RACI**

Based on the activity flow the RACI was developed for this activity as per Table 4-22.

Table 4-22: RACI for activity flow J

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
PM	PEC	PD	PMO

c) **Critical controls**

The PEC has now been granted a mandate to conclude contracts with compliant PDs, this mandate must be respected and strictly adhered to, as the committee is now authorised to conduct technical, financial and commercial approvals. In the ESCO process the PEC was authorised to conduct technical approvals only.

d) **Suggested time for PEC approval**

Seeing that the PEC agreed to meet weekly, the committee’s approval time was initially set at 1 week, however the requirements of the committee are detailed, hence it was decided to re-set the approval time to 2 weeks.

❖ **<u>Activity flow K</u>**

a) **M&V request & Baseline developed**

In this step an M&V entity is appointed by Eskom, via the request of the PM, to establish an independent baseline at the customer’s facility to determine the current electrical energy consumption. The M&V organisation is an independent third party and the costs of the M&V are paid by Eskom. The process followed by the M&V body is similar to that of the ESCO process; hence no developmental changes were made to this step as compared to the ESCO process.

b) **Determining the RACI**

Based on the activity flow the RACI was developed for this activity as per Table 4-23.

Table 4-23: RACI for activity flow K

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
PM	TEC	PD	PMO

c) **Determining the critical controls**

The baseline development is a key step in the SO process, as the incentive payments to PDs are determined by comparing the actual performance of the project against the baseline. The baseline must be signed off by the PD, M&V and IDM.

d) **Suggested time to develop a baseline**

The time proposed by the M&V entity to develop a baseline is 6 weeks.

❖ <u>Activity flow L</u>

a) PD signs SO contract

The signing of the SO contract is to ensure a legal contract exists between Eskom and the PD. Payment based on performance to the PD, is governed by the conditions of this contract. The development of the SO contract is a major shift in thinking from the ESCO process contract mechanism, as the project risks are transferred to the PD.

In the ESCO process it was seen that the contracting process with the ESCO was an onerous task. Contracts were lengthy and could take up to 12 months to conclude.

In the new process the SO contract was developed, (as per activity flow B6) to be simple and easy to understand.

In this step the PD is now ready to sign the new SO contract. The development of the SO contract makes provision for:

- Baseline development
- Eligible technologies
- Measurement acceptance date
- Payment structures
- M&V
- Payment and refund processes
- Product developers' obligations
- Eskom's obligations
- Guarantee and indemnities
- Dispute resolution
- Breach and Termination

The PM has to populate the SO contract, by completing the required fields namely:

- PD details
- Details of the Customer
- Details of the approved technology
- Minimum kWh savings
- Duration of contract
- Domicile address of both Eskom and the PD

On completion of the above, the PD is sent a copy of the contract for signatures, thereafter the contract is signed by the authorised person in IDM.

b) **Determining the RACI**

Based on the activity flow the RACI was developed for this activity as per Table 4-24

Table 4-24: RACI for activity flow L

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
PM	Senior General Manager (IDM) / PD	Legal department	M&V

c) Critical controls

The SO contract must be signed by both IDM and the PD before the project can be implemented. If implementation starts without the contact being signed, the PD will not be compensated retrospectively.

d) **Suggested time to sign SO contract**

The suggested time to conclude the signing of the SO contract is 1 week; this is to allow the PD to fully understand the contract conditions and risks thereof.

❖ **Activity flow M**

a) PD implements project

In developing this activity, it had to be ensured the PD takes full accountability for the project implementation, the speed and quality of the installation. The PD must implement, complete and commission the Approved Technology at the Facility at its sole cost and risk.

Based on the author's experience with the ESCO process, project implementation could take longer than 12 months to complete with the ESCOs continuously asking for more extensions. This negates the whole purpose of rapid implementation of EEDSM projects in SA. Due to this, the SOP is designed to allow the PD only 6 months in which to complete the project implementation.

b) **Determining the RACI**

Based on the activity flow the RACI was developed for this activity as per Table 4-25.

Table 4-25: RACI for activity flow M

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
PD	PD	PM	M&V

c) Determining the critical controls

Prior to implementation the PM needs to ensure the M&V Plan, Baseline and SO contract have all been signed.

d) **Suggested time to implement project**

The maximum time that is allowed for project implementation is six months as EE savings are urgently needed.

❖ **Activity flow N**

a) Disposal of old technologies

An extract from the new SO contract specifies:

"Dispose of old luminaries or other goods or equipment which needs to be disposed of, in accordance with the requirements of the Hazardous Substances Act no. 15 of 1973, Environmental Conservation Act no. 73 of 1989 and regulations of the Department of Water Affairs and Forestry, and any additional applicable legislation."

b) **Determining the RACI**

Based on the activity flow the RACI was developed for this activity as per Table 4-26.

Table 4-26: RACI for activity flow N

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
PD	PD	PM	M&V

c) **Determining the critical controls**

The PD must obtain a certificate by an independent disposer indicating the disposal of equipment or other goods was executed in an environmentally friendly manner and they will not be reused.

d) **Suggested time to dispose of old technology**

The suggested time for the PD to dispose of the old technology is two weeks.

❖ **<u>Activity flow O</u>**

a) Post M&V assessments

This activity flow is as per the M&V guideline developed for the SO programme (37). On completion of the project, the PD will submit a certificate of completion (CoC) to the PM for approval. On approval, the PM will notify M&V to conduct the first performance assessment.

The PD provides the M&V entity with post implementation data, including installation details and disposal certificates. The M&V body will perform an assessment over a period of 4 weeks, called the measure acceptance period (MAP) and thereafter produce the first performance assessment (PA) report.

b) **Determining the RACI**

Based on the activity flow the RACI was developed for this activity as per Table 4-27.

Table 4-27: RACI for activity flow O

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
M&V body	M&V body	PD	PM

c) **Determining the critical controls**

The PM must check if there are any variables that could affect the verified savings negatively. Often due to seasonality and Customer production patterns, performance can vary. Projects might underperform during the measure acceptance period but will then catch up during the course of the year.

d) **Suggested time to produce a PA report**

According to the M&V guideline, the suggested time to produce a signed performance assessment report is 6 weeks subject to the necessary information being available.

❖ **<u>Activity flow P</u>**

a) **PD submits 1st invoice for payment**

In this step, the PM will instruct the PD to submit the first invoice to IDM for payment based on the PA report. Based on activity flow B7, IDM will pay 70% of the contract value to the project developer on the Measure Acceptance Date (MAD), and within 30 days of receipt of a valid tax invoice.

b) **Determining the RACI**

Based on the activity flow, the RACI was developed for this activity as per Table 4-28.

Table 4-28: RACI for activity flow P

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
PM	PD	Finance	M&V

c) **Determining critical controls**

The PM must use the accepted PA report to calculate the rebate payable to the PD in line with the SO terms and conditions.

d) **Suggested time to pay invoice**

According to the SO contract, the PD will get paid within 30 days of receipt of a valid tax invoice.

❖ **<u>Activity flow Q</u>**

a) Annual M&V assessment over 3 years

This activity is as per the M&V guideline developed for the SO programme (36). The second performance assessment will be calculated twelve months after the commencement of the sustainability period (from MAD). Metered data for twelve months will be used to determine the project performance between 6.00 am to 10.00 pm Monday to Friday, only.

The PM will again calculate the rebate value based on the PA report, and will thereafter instruct the PD to invoice another 10% of the contract value.

b) **[Determining the RACI]**

Based on the activity flow, the RACI was developed for this activity as per Table 4-29.

Table 4-29: RACI for activity flow Q

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
M&V body	M&V body	PD	PM

c) **Determining the critical controls**

The PM must ensure good records and proper filing are in place as the PD must be paid over a period of 3 years. If the PM leaves IDM within the 3 years, a proper handover to the new PM must be done with both PM's signing a take-over certificate.

4.5. CONCLUSION

In this Chapter the new SO process was developed using the framework for managing complex situations under the Systems Thinking Approach. The ten steps of this approach were applied in determining high leverage interventions, where managing the right things lead to large improvement gains.

Thereafter the process was aligned to Eskom's PLCM model, which is a series of sequential phases a process passes through from the initiation to the close out. The PLCM allowed the framework to develop a process that is transparent, showing clear roles and responsibilities of each activity and locking in critical controls and approval gates for each phase.

By applying the above techniques, three of the five objectives were embedded in the new process; namely:

- Streamlined approval process
- Eskom's risk reduced by making the payments performance-based and pay only for measured and verified savings
- Improve time taken to evaluate EEDSM projects

The other two objectives can only be determined after the new process has been opened to the market and tested as a case study; to recap these two objectives are:

- Increased market uptake for Energy Efficiency
- Reduced burden on Eskom staff

Comparing the SO application process to the ESCO process as per Table 4-30, it can be seen that the SO process should significantly reduce time taken to evaluate EEDSM projects.

Table 4-30: Comparison between the ESCO and new SO process

Phases	Activities	ESCO process	New SO process
Phase 1	***Activity***	***Average time to complete activity 1 to 3***	***Suggested time to complete activity 1 to 3***
DSM investigation by ESCOs	1. ESCOs market DSM to obtain Letter of Intent (LOI) 2. ESCOs conduct detailed audit at customer site 3. ESCOs formulate project and submits to IDM for funding	3 to 6 months	7 weeks
Phase 2	***Activity***	***Average time to complete activity 4 to 8***	***Suggested time to complete activity 4 to 8***
Project evaluation by IDM	4. Technical evaluation 5. PEC approval 6. Request M&V to develop baseline 7. Financial evaluation 8. Commercial evaluation	**6 to 12 months**	**7.5 weeks**
Phase 3	***Activity***	***Average time to complete activity 9***	***Suggested time to complete activity 9***
Develop project baseline M&V	9. M&V to develop project baseline to determine "as is" operation of the facility	12 weeks	6 weeks
Phase 4	***Activity***	***Average time to complete activity 10 & 11***	***Suggested time to complete activity 10&11***
Contracting	10. ESCO signs implementation contract with IDM 11. Customer signs DSM agreement with IDM	**3 to 15 months**	**2 weeks**
Phase 5	***Activity***	***Average time to complete activity 12***	***Suggested time to complete activity 12***
Implementation	12. ESCO implements project at customer site as per the conditions of contract	(project dependent, average – 12 months)	Up to 6 months
Phase 6	***Activity***	***Average time to complete activity 13 & 14***	***Average time to complete activity 13 & 14***
Performance assessment & maintenance	13. Performance assessment by M&V 14. Customer maintain savings for 5 years	(Up to 3 months)	6 weeks

In the next chapter the new SO process will be applied to a commercial facility to test the process against:

- approval time lines from submission to execution of the project;
- process effectiveness in comparison to the ESCO process;
- the critical controls of each activity.

Chapter 5

5. CASE STUDY

5.1. INTRODUCTION

In the previous chapter the new SO process was developed. In this chapter the new SO process will be implemented and tested on a large commercial retail facility in SA. The case study will be tested against the new SO process to validate the following:

- approval time lines from submission to execution of the project
- process effectiveness in comparison to the ESCO process
- the critical controls of each activity

As the confidentiality of the PD, the Customer and the M&V entity will be respected, the name and location of the Project will remain anonymous. It will therefore be referred to as, “project A” for the remainder of the case study. The customer will be referred to as, “the Customer”.

In this case study, the Customer requested the services of a PD to reduce electrical energy use at the Customer’s retail stores nationally. Many PDs were screened by the Customer and finally a decision was taken by the Customer to appoint a locally based PD. After signing the LOI with the Customer the PD conducted a high level investigation at the Customers stores and recommended to the Customer that the existing in-efficient lighting system be retrofitted with EE lighting technologies, using the SO process.

This case study focused on the details of the lighting retrofit opportunity at the first 30 retail stores of the Customer in Gauteng and the northern regions of SA using the SO process. The new SO process developed in Chapter 4 is summarised in Table 5-1. The rest of this chapter will follow the logical flow as shown in Table 5-1 with the letter sequencing being used. The SO project application process starts from activity F1 and ends at R. Key observations will be discussed at each activity flow.

Table 5-1: SO application process with suggested timelines to complete each phase

Phases	Activities	New SO process
Phase 1	***Activity***	***Suggested time to complete activity F1 and F2***
EEDSM investigation by PD	F1 - PD markets SOP to obtain LOI from the customer F2 – PD formulates project submission to IDM	7 weeks
Phase 2	***Activity***	***Suggested time to complete activity G to K1***
Evaluation of project by IDM	G- PD registers as a vendor with Eskom H- Project screening and registration by PM I – Assessment and approval of project by TEC J – PEC approval of project K 1 - PM request M&V to develop project baseline	7.5 weeks
Phase 3	***Activity***	***Suggested time to complete activity K2***
Development of project baseline	K2 - M&V to develop project baseline to determine “as is” operation of the various stores	6 weeks
Phase 4	***Activity***	***Suggested time to complete activity L***
Contracting	L - PD signs SO contract with IDM	2 weeks
Phase 5	***Activity***	***Suggested time to complete activity M and N***
Implementation	M – PD implements project as per the terms of the SO contract N – PD disposes of old technology	Up to 6 months
Phase 6	***Activity***	***Suggested time to complete activity O and P***
Performance assessment & maintenance	O – Post measure acceptance period performed by M&V P – Project sign off and first invoice submitted for payment by the PD Q – Annual M&V assessment over 3 year sustainability period R – IDM releases retention money over contract period	6 weeks

<u>Step 1 - PD markets SO programme to obtain LOI from the Customer (*activity flow F1*)</u>

(Time suggested to obtain LOI - 3 weeks, actual time spent - 2 weeks)

Following on the launch of the Standard Offer Programme (SOP) by IDM, PDs began approaching customers to market the new SOP immediately.

Early July 2012, the PD made contact with the Customer to set up an appointment to promote the SOP. Two weeks later the Customer met with the PD. The PD understood the requirements of the SOP and was comfortable in selling the SO concept to the Customer. In the marketing phase the PD set the scene by explaining the electricity shortage situation in SA and the need for rapid implementation of electricity saving projects. The PD further went on to explain the rules and requirements of the new programme, which was published on Eskom's website. This gave the programme credibility as the PD was able to refer the Customer to the website for further information and verification of the SOP rules. The PD explained the financial, technology and environmental benefits of implementing the SO to the customer. The Customer, seeing the benefits of such a programme, signed a LOI with the PD on the 27 July 2012.

1.1 Key observations on activity F1

According to the PD, obtaining the LOI was much quicker than anticipated. The suggested time allocated for this step is three weeks to allow the Customers legal department to sign the LOI. The LOI was signed in two weeks, which demonstrated the Customer was keen on energy savings and also understood the new process requirements and the risks thereof.

The PD indicated some discomfort in signing the LOI, as the Customer added an extra clause that instructs the PD to use the Customers maintenance team to do the installations of the new lighting technologies; the reasons being the Customers maintenance team understood the facilities electrical system and operations better than the PD. The PD complied with this request despite losing potential profit on the installation. The PD was also aware that the LOI would expire in 2 months, and thereafter the customer could approach another PD to perform the work if the PD failed to submit an application to IDM within the required time. The PD also indicated that he was willing to break even (from a cost perspective) on the first project in order to build up his company profile.

Aside from the LOI, positive feedback was received from the PD regarding IDM's approach to publish the SO rate nationally. By knowing exactly what IDM's financial contribution to the project would be, the PD was enabled to proactively sell the SOP, thereby creating a healthy pipeline of projects for the PD.

1.2 Comparing the SO process against the ESCO process for activity F1

In comparison to the ESCO process for the same activity (Table 5-2), the SO process has proven to be an easy sell to the Customer. The process is transparent and well understood by all parties. The time taken to obtain a LOI is significantly reduced thereby leading to greater market penetration in the commercial and industrial sector.

Table 5-2: Comparison between the SO and ESCO process for activity F1

OBTAINING LOI		
Key Observations	**ESCO process**	**SO process**
1	• ESCOs find it difficult to sell the ESCO process to customers as the programme rules are neither well defined nor transparent. • The ESCO process was not published on Eskom's website at the time.	• The PD indicated that it was an easy sell to market the SOP. • The SOP process was transparent and well understood. • The SOP programme was published on Eskom's website.
2	• The time taken for ESCOs to obtain a signed LOI from customers could take up to 2 months.	• The suggested time for the PD to obtain a signed LOI is set at 3 weeks.

1.3 Critical Controls for activity F1

The PM has to check the LOI is signed between the PD and the Customer. If the LOI is not signed it will be regarded as null and void, in addition the PD could expose himself to performance risk at a later stage in the process. The PM also has to make sure the LOI has not expired when reviewing the project.

Step 2: PD formulates project and submits to IDM for funding approval (activity flow F2)

(Time suggested to formulate project - 4 weeks, actual time spent - 3 weeks)

Following on from the signing of the LOI, the PD started the detailed energy audit at the Customer's facility on the 30 July 2012. The audit included the identification of large electricity users, plant layouts, historical data and process flows, which informed the development of a project proposal. By the modelling of consumption data, problem stores were identified, and comprehensive energy audits completed. Technical opportunities were identified pertaining to voltage supply, refrigeration, and lighting, with the focus on lighting for this case study. The key project information of the Customer's stores is summarised in Table 5-3.

Table 5-3: Customer site information

Site information	
Type of customer	Food retailer
Total electricity usage (kWh) all stores	569 000 000
Electricity usage per m^2 per annum	573
Operating hours of stores	7 days per week with varying operating schedules for weekdays, Saturdays and Sundays
Time of operations	During the week, from 8.00 am to 8.00 pm, on Saturday and Sunday from 8.00 am to 5.00 pm.
Site location/s	All provinces in SA

Following the audit the PD requested the necessary SO project templates from the PM at IDM. The PD completed the template, which was then signed off by the Customer and submitted to IDM for funding consideration on the 17 August 2012.

2.1 Key observations on activity F2

Formulating the project submission by the PD was quicker than anticipated. The PD indicated the success factors that contributed positively to packaging a speedy project proposal to IDM were:

- Prior to signing the LOI, the Customer already had an energy management policy for the group, which called for a reduction in operating expenditure and of greenhouse gases and emissions. Each store manager had to comply with the policy.
- The Customer appointed a dedicated Energy Manager at head office to assist the PD to gather project information from the stores.
- The Customer had permanent meters that recorded electricity usage at 30 minute intervals.

Although the PD submitted the project to IDM before the suggested timeline of 4 weeks, clarification on the SO template was needed by the PD, which was addressed by the PM. In one instance the PM identified discrepancies in the submission, which the PD had to rectify.

2.2 Comparing the SO process against the ESCO process for activity F2

When compared to the ESCO process (Table 5-4), it was found the PD had a higher confidence level in the SO process with regards to project approval.

Table 5-4: Comparison between the SO and ESCO process for activity F2

Formulating project proposals		
Key observations	**ESCO process**	**SO process**
1	• ESCOs allocate time and funding to investigate EEDSM projects that may eventually not be funded by IDM due to incorrect technical information provided or budget constraints.	• The PD had a high confidence level of project approval, as the rules rates, and the technologies of the SOP are published upfront. • SO budget drawdowns are shared with PD at regular intervals.
2	• Time taken to develop a project can be greater than 3 months.	• Suggested time to formulate a project proposal is set at 4 weeks.

2.3 Critical controls for activity F2

The PM has to ensure the project submission from the PD is signed off by the Customer before the project can be considered for IDM funding. Based on experience from the ESCO process, some project submissions to IDM were not seen by the Customer; hence the Customer did not know what potential financial and legal risks could follow on the project.

Step 3: Register PD as a vendor with Eskom (Activity flow G)

(Time suggested to register PD as a vendor - 2 week, actual time spent - 4 weeks)

Following the project submission to IDM on the 17 August 2012, the PD then started the vendor registration process with Eskom. On the 20 August 2012, the PD submitted vendor forms as per Table 5-5 to Eskom to be registered as a vendor. The forms were checked by the project administrator at IDM who found that the PDs tax clearance certificate had expired. The PD was then notified immediately to rectify the situation.

Table 5-5: Eskom vendor registration process

Requirements	Description
1	Original cancelled cheque or letter from the bank verifying the banking details.
2	Certified copy of business registration documents of company.
3	Valid and original tax clearance certificate
4	Proof of registration with UIF.
5	Proof of registration with compensation fund for workers.
6	A copy of the CIDB (Construction Industry Development Board) certificate.
7	Proof of professional registration.
8	Shareholder certificates or the shareholder's agreement.
9	Confirmation of % black ownership and black management within the company.
10	Latest verified annual financial statements confirming annual turnover, Net Profit Before Tax (NPBT) and total cost of labour.
11	Letter signed off by an auditor or a certified accounting officer confirming that the entity is newly incorporated and is in its first year of operation.

3.1 Key observations on activity flow G

The suggested timeline to register the PD as a vendor is 2 weeks provided all vendor requirements are met. The actual time spent was 4 weeks; hence the PD was registered on the 14 September 2012. The reasons for the delay:

- The PD had to source the latest copy of his company's tax clearance certificate as the one submitted with the project had expired.
- The PD had to seek clarity from CIDB on the minimum requirements to be accredited by the Board.

3.2 Comparing the SO process against the ESCO process for activity G

The vendor registration steps for the ESCO process and SO processes are the same; hence there was no need to do a comparison of the processes.

3.3 Critical controls for activity G

This step is a mandatory requirement for all PDs, failing to register as a vendor will prevent the PD from receiving payments or doing business with Eskom.

Step 4: Project Screening and registration by PM (Activity flow H)

(Time suggested to screen and register project - 1 week, actual time spent - 3 days)

Upon registering as a vendor, the PM started the screening and registration of the project on 17 September 2012. This was in line with the newly developed project registration template shown in Table 5-6. The template directed the PM to look for specific fields in the project submission. Some information was not available in the project submission hence the PM immediately requested this information from the PD. Once completed the PM submitted the information to the Programme Management Office (PMO) for a project number to be allocated.

Table 5-6: Project registration template

Project Number	**2012xxxx**
Project Name	Project A
Programme funding model	Standard Offer
Sector	Commercial
Technology	Lighting
Distribution Region	Central, Northern, North West
ESCO (if applicable)	Project Developer
Customer Name	The Customer
Letter of Intent (LOI)	Yes
Proposed Megawatt savings	0.4264
Technical Load Factor	0.49
Proposed MWh savings per annum	1 774
Project Cost	R 2 234 802
Time to Implement (in months)	4 months
Project Status	Submission to PEC
Proposed Start Date	November 2012
Proposed End Date	End January 2013
M&V Request submitted (if applicable)	Pending

4.1 Key observations on activity flow H

It was anticipated the screening and registration of projects would take at least 1 week, however due to the implementation of the new SO project registration template (Table 5-6) the time taken by the project manager to complete the task was 3 days.

The PM indicated the project registration process was a pleasant experience and fairly simple. Certain fields of the template were filled in by the PD and verified by the PM. The registration template guided the PM to look for key information in the project proposal, which led to a quicker turnaround time and reduced the administrative burden on the PM.

The DSM manager at the time was not happy that the PM did not screen the project in parallel with the vendor registration process. Although the vendor registration is mandatory, the PM could have followed up with the vendor management department as to the delays, and thereafter taken calculated risks to proceed with the screening of the project, which will be subject to the tax clearance certificate coming later.

4.2 Comparison between SO and ESCO process for activity H

When comparing the SO to the ESCO process as per Table 5-7, it can be seen the new SO process are transparent thereby leading to better screening controls, which result in projects being registered quicker.

Table 5-7: Comparison between SO and ESCO process for activity H

Project Screening and registration		
Observations	**ESCO process**	**SO process**
1	• Projects were not registered by IDM, as the registration process was not transparent and not well understood by the PD and PM.	• Project registration was quick, transparent and well understood by the PD and PM.
2	• Registrations were managed using an inefficient system, which was not easy to use, time consuming and lacked transparency.	• The new Registration template shown in Table 5-6 was easy to understand and enhanced the working relationship between the PD and PM.
3	• Frequent requests for more information had to be made with corresponding delays.	• Additional information was requested once by the PM.
4	• Project screening and registration could take up to 2 months.	• Suggested time to screen and register project up 1 week.

4.3 Critical controls for activity H

The PM had to ensure the information required in Table 5-6 was provided timeously. This information is used by the Programme Management Office (PMO) to capture key information on the project to allow for better statistical reporting to key stakeholders and serves as a tracking number for the PD.

Step 5: TEC Evaluation (Activity flow I)

(Time suggested for evaluation by TEC – 2 weeks, actual time spent - 1 week)

After project registration, the PM submitted the project to the Technical Evaluation Committee (TEC) on 24 September 2012, in the format requested by the committee. The TEC assessed the technical soundness and viability of the project for approval to the Project Evaluation Committee (PEC). The TEC requirements in the new process were transparent, and easy to understand. The templates developed for TEC submission were based on experienced gained from the ESCO process. The PM submitted and explained the following information to the TEC which covered:

- The project SOW
- Description of the new EE technology
- Electrical load profiles showing current consumption at the Customer's stores
- Load reduction calculations

➢ **Scope of work**

The SOW from the project submission packaged by the PM entailed the conversion/ replacement and upgrade of the T8 (Tubular diameter) fluorescent light fittings to T5 EE fluorescent light fittings. The conversion upgrades of the old white reflector T8 type fitting to a highly efficient aluminium reflector, was done replacing the double T8 lamps and ballast (magnetic or electronic) with a new single T5 lamp and ballast. The conversion allows for a minimal reduction in light output, while considerably reducing total system power usage. The conversion was scoped according to the number of lamps, height and application of the luminaire.

To arrive at the SOW the PD had to conduct an audit on the first group of 81 stores. From this, a batch of 30 stores based on priority was selected for phase 1. The steps taken by the PD to arrive at the SOW were:

- A detail audit process which includes a site inspection, counting all light fittings and lamps, reviewing operating parameters was concluded.
- Tariff and billing information was gathered for the stores total electrical energy consumption.
- The above information was then processed, analysed and used as input in the design process.
- Proposed energy optimisations, highlighted by savings per site per target area, were presented to the client for final selection.

➢ **A description of the new technology (specification)**

The PD submitted the specification to IDM as per Table 5-8 with the intention to retrofit the old technology with the following new technology. The technology was assessed by the TEC and was given the go-ahead within the project.

Table 5-8: New EE technology specification

Type	Length	Product name	Rated Power	Lumen [lm @ 25^{0}C]	Colour rendering index (CRI)	Correlated colour temperature (CCT) [K]	Service Life (hours)
T5	5 Ft	Lumilux T5	49W	4300lm	80..89	4000	18 000
T5	4 Ft	Lumilux T5	54W	4850lm	80..89	4000	18 000

The conversion reduced the light level by about 20%, which translates into a lux level measured 1m above floor level, of around 900 lux. Extensive customer surveys conducted by the PD indicated this reduction in light level would be sufficient for the Customer. The Customer requested the new technology comply with the minimum lighting specification as per the Occupational Health and Safety Act (OHSACT).

- **Electrical load profiles**

Determining the electrical load profiles was conducted by the PD. According to the PD, this step was fairly quick, as the Customer has a metering solution, which consists of main and back-up meters. These permanently installed meters record data at 30 min intervals and are read by an external metering company and stored on a database. On all sites included in this project the main meters have been certified by an independent metering company.

To determine the current electrical consumption of the Customer, the PD used multiple data sources; namely kWh consumption and audit information, which is processed, analysed and used as input in the development of the electrical load profiles. Information obtained from the site audits is used to determine the current lighting demand. A full record of all the fittings installed, lamps in fitting and lamps out was gathered and documented. This process accurately recorded the lighting kW demand for each site.

With specifications known for the installed system and the solution, a power reduction can be calculated per fitting. Given the store operating times, a daily energy saving is established for each proposed solution. Grouping the solutions into the respective functional areas, energy savings are quantified per target area. The 24 hour electrical load profile after retrofit is modelled under perfect conditions, with a key switch already in place to switch all or specific lights off after store closure, and on for store opening.

All the sites included in this proposal have a simulated profile for a total lighting load and for each target area. Figure 5-1 shows the total lighting load profiles for each store (baseline). The proposed profile shows the actual load, with lamps out at the time of the audit.

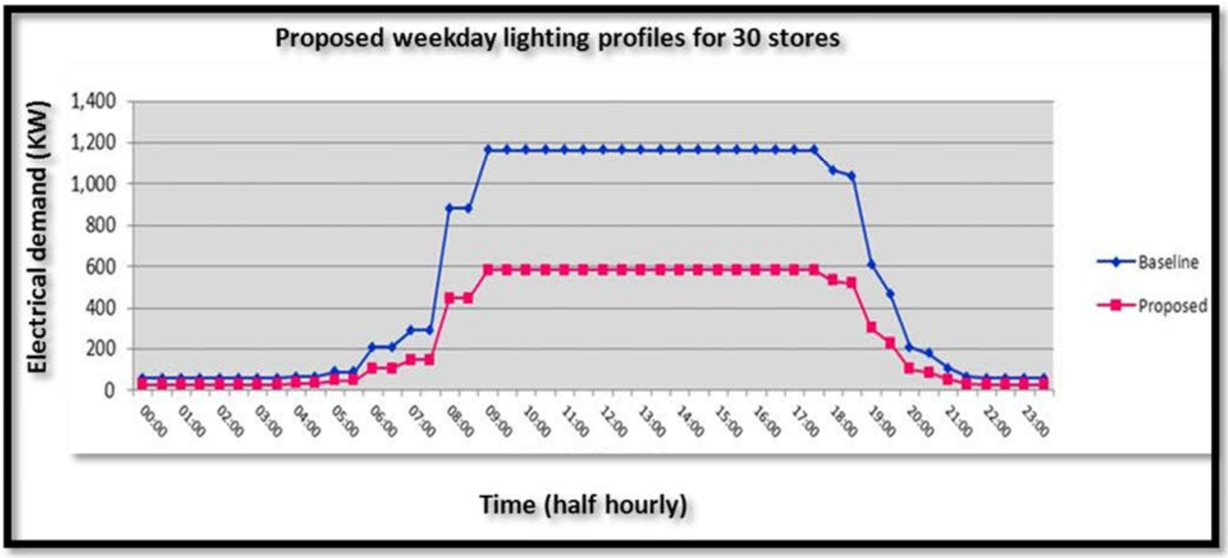


Figure 5-1: Proposed weekday lighting power profiles of the Customer

➢ **Load reduction calculations**

In formulating the baseline, the PD with the Customer made a few assumptions, namely:

- The power factors of the various lights are stable.
- The frequency of the electric supply is stable.
- There will be no other energy interventions on the lights by the client.
- There will be no new lights added to the project scope.
- The operating schedule of the post-implementation case will be the same as the current lighting system.

➢ **Project checklist**

The PM had to complete the project checklist as per annexure A to ensure all information relating to the project had been submitted. The checklist covers parts A to E, as follows:

Part A: General project information

Part B: Technical information

Part C: Requirements for specific technologies

Part D: Information required for PEC submission

Part E: M&V information

5.1 Key observations on activity flow I

It was anticipated that the evaluation by the TEC would take 2 weeks to complete due to the level of information required. Actual time taken by TEC to evaluate the project was 1 week and was completed on 21 September 2012. According to the senior manager of the technical department, the main reason for the quick turnaround time was the result of a quality submission by the PM to the committee. The PM complied with the templates, checklist and requirements of TEC. The PM also indicated the new project checklist developed for the SOP was a huge improvement as compared to the ESCO process checklist. By following the checklist the PM knew exactly what was required by TEC.

5.2 *Comparing the SO process against the ESCO process* for activity I

When comparing the SO to the ESCO process as per Table 5-9, it can be seen the new SO process is transparent and clear with regards to the information needed to evaluate the project, thereby leading to improved approval times.

Table 5-9: Comparison between SO and ESCO process for activity I

TEC evaluation		
observations	**ESCO process**	**SO process**
1	• There was insufficient staffing in the technical section to evaluate projects; hence staff could not cope adequately with the incoming workload.	• The PM is now accountable to complete the TEC checklist, hence less burden on the technical section resources.
2	• Proposals were often rejected as the proposal evaluation process was not well understood.	• The new TEC checklist guided the PM and PD as to the requirements of TEC, thereby leading to better understanding of the process.
3	• Good commercial sector EE projects were being disqualified because they operated outside the evening peak periods, and there were no incentives to encourage energy efficiency projects.	• The new process encourages good EE projects that save energy between 6.00 am to 10.00 pm.
4	• Time taken to evaluate projects could be as long as 3 months.	• Suggested time to evaluate projects is set at 2 weeks.

5.3 Critical controls for activity I

The PM had to comply with the requirements of TEC by completing the checklist as per Annexure A prior to PEC submission.

Step 6: PEC approval (Activity flow J)

(Time suggested for PEC approval - 2 weeks, actual time spent 1 week)

Following on TEC approval the PM prepared and submitted the project to the PEC members on 01 October 2012 for review. Due to the urgent need for EE projects the PEC Chairman decided to have a committee meeting once a week; hence the PEC meeting was held on 04 October 2012. The requirements of the PEC were clear. The committee requested the following documents from the PM in order to make an informed decision on the project:

- The project registration form completed by the PM
- TEC checklist completed by the PM
- An overview of the project risks and possible mitigations

Considering the above, the PM presented at PEC on 04 October 2013, and requested the PEC approve the implementation of the SO project to reduce the lighting electrical load by 426.4 kW at various Customer stores. The PM summarised the energy savings, cost and time to implement the project as per Table 5-10. This gave the committee a summarised view of what was required for easy decision making.

Table 5-10: Summarised request of the project to the PEC

Rebate Value	42 c/kWh
kW Saving (Average Monthly)	426.4 kW
kWh Saving (Yearly @ 4,160hrs)	1 773 652 kWh
Total Capped Value (IDM's contribution only)	R 2 234 802
Project Implementation period	4 months

As per the request of PEC, the PM with the PD had to also identify possible project risks and mitigations. These risks as shown in Table 5-11 were summarised with the mitigations. As per Table 5-11, the PD had to rate the risk impact from a score of 1 to 10. Thereafter the PD with the PM had to determine the probability factor of the risk materialising. The risk level was then calculated by multiplying the risk impact with the probability. A low risk will be shown in a green highlight, the medium risk will be shown in yellow, and high risks in Red.

Table 5-11: Project Risks and Mitigations

Risk description	Risk Impact (A)	Probability (B)	Risk Level (A x B)	MITIGATION
1. Component failures.	5	2	Low (10)	• A warranty period of 3 years was given to the Customer to exchange any faulty equipment.
2. PD ability to complete project on time.	7	3	Low (21)	• Suppliers will be given sufficient lead time to plan the ordering of equipment for the project. • The PD will plan the work to ensure minimal disruption to the Customer's trading hours. • Installation contractors will work in a team to speed up installation time.
3. Installation of switching devices that change the simulated lighting profile.	8	5	Medium (40)	• A key switch is inherently planned into the lighting design. The energy management program with daily dashboards will manage the correct use of the switch.
4. Safety, Health and Environmental (SHE) incidents occurring.	10	4	Medium (40)	• A SHE plan will be compiled, to be reviewed by IDM and implemented during project execution. This plan will also address safe disposal of old light fittings.
5.Supplier Development and Localisation (SD&L)targets not being met.	8	5	Medium (40)	• SD&L performance to be tracked throughout project execution by the PM and feedback given to the commercial department.

Another key criterion of the PEC was to determine how many new employment opportunities would be created in South Africa if the project was approved. The PD via the PM submitted a resource plan to PEC as per Table 5-12, showing the number of new employment opportunities that would be created subject to project approval by PEC.

Table 5-12: Employment opportunities to be created subject to PEC approval

Employment Opportunities	PD feedback
• The number of new employment opportunities that will be created due to the IDM Funded project.	• This project will require a total of 4 senior technicians (electrical) and 12 electrical assistants to implement the project over and above the Customers resources.
Training that will be offered to new (and existing) employees.	• On the job and class room training will be held for the new resources.
• Characterise the new employees by age. • Female or Male.	• Youth between 18 and 35. • Male.
Duration of the employment of these new employees.	• 2 to 4 months.

The PEC reviewed all the information submitted to the committee, which included:

- The project registration form completed by the PM.
- TEC checklist completed by the PM.
- An overview of the project risks and possible mitigations.
- Employment opportunities identified on the project.
- Power Point presentation of the project request by the PM.
- Excel spread sheets showing the calculations of the electrical load profiles.
- Project proposal as submitted by the PD.

On review of the above, the PEC granted approval of the project on the 04th October 2012. The PD was informed of the outcome by the PM.

6.1 *Comparing the SO process against the ESCO process* for activity J

With the ESCO process, projects were often rejected as the PM could not adequately address the questions raised by PEC members. Frequent requests for more information had to be made to the ESCO by the PM, leading to corresponding delays. With the SO process the information required by the PEC was prompted at the TEC phase via the newly developed SO templates and checklist. 95% of questions normally asked at PEC are now covered by the TEC templates and checklist. If the PD and PM comply with these requirements, the approval from the PEC will be quick.

6.2 *Critical controls* for activity J

On approval from the PEC, the PM had to ensure the PD does not start implementation prior to the baseline and SO contract being signed. The PD assumed the project could start based on PEC approval. As a control measure the PM followed up with a letter to the PD.

Step 7: Baseline development (Activity flow K)

(Suggested time to develop baseline - 6 weeks, actual time spent - 4 weeks)

Following on from the PEC approval on the 04 October 2012, the PM completed the M&V request form (activity K1) on the 05 October 2012. This request was submitted to the M&V entity to start with the development of the baseline, which consisted of the load profiles and the relevant electrical energy consumption of the Customer.

The purpose of independent M&V is to measure and verify the savings that will occur due to the replacement of existing 1.5m and 1.2m (and further) T8 fluorescent lamps with 5 foot and 4 foot T5 fittings at 30 corporate stores nationally. According to the M&V request form compiled by the PM, the anticipated reduction in demand is 426.4 kW from 6.00 am to 10.00 pm on weekdays; this is equivalent to 1774 MWh savings per annum.

The M&V team used the same M&V guidelines for EEDSM projects (38), which also conform to SA National Standards (SANS) 50010:2011 (37), while at the same time allowing for a more flexible and streamlined process in the spirit of the SO in order to accelerate energy savings opportunities.

To develop the baseline (activity K2), the M&V team had to first scope the project by gathering site information. The site information gathered (38) covers these situations:

- The stores operate 7 days a week with varying operation schedules for weekdays, Saturdays and Sundays.
- During the week, they operate from 8.00 am to 8.00 pm, on Saturdays and Sundays from 8.00 am to 5.00 pm.
- The different stores operate on different electricity tariff structures. Among these are Eskom night save, City Power Low voltage, Eskom Mini-flex, Tshwane LV and many others.

The M&V team performed a site visit middle of October 2012. The team indicated it was not possible to do a comprehensive measurement of all the installed lighting at each site due to constraints on time and extensive travel requirements. Rather, certain stores were visited in the Gauteng area, which include Bedfordview, Florida, Sunward Park and Rosebank.

The M&V team indicated the accuracy of the scoping study depends on the accuracy of the database submitted by the PD of existing lights and their associated light quantities. Unfortunately, the M&V team cannot verify every single quantity of lights at each facility. Therefore, if the database provided by the client is inaccurate in any way, then those inaccuracies could creep into the savings calculations.

The development of the baseline was based on the current lighting system capacity and the lighting operating schedule. The overall power consumption of the existing lighting system was established based on the quantities of the fittings that were confirmed during the site visit and their actual power consumption. A multi-meter was used to determine the power consumption for every half hour interval of operation. The same procedure will be used to determine the load profile and the energy consumption of the newly installed fittings after the EE intervention is finished. The team then formulated a baseline for all the stores rather than individual stores as per Figure 5-2.

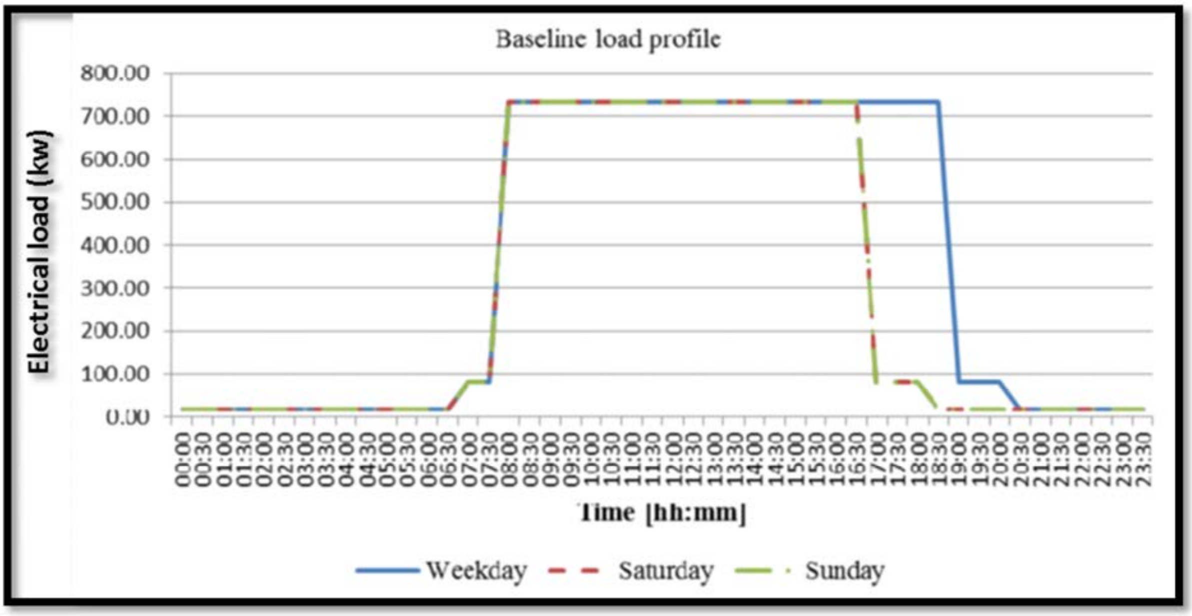


Figure 5-2: Load profile for Weekday, Saturday and Sunday (38)

7.1 Key observations on activity K:

The request to the M&V body was submitted on the 5th October 2012. According to the M&V entity, the estimated time to set a baseline for the project is 6 weeks, however the actual time spent on setting the baseline was 4 weeks. The baseline was completed and signed on the 5th November 2012. This was a remarkable achievement by the M&V entity. The PD also played a key part in the M&V process by ensuring all M&V requirements were met timeously and facilitated easy access to the Customer site.

7.2 ***Comparing the SO process against the ESCO process***

In comparison to the ESCO process, the time taken to develop the project baseline using the SO process was significantly reduced. Table 5-13 explains some of the reasons for this.

Table 5-13: Comparing the SO baseline development against the ESCO process

Baseline development		
Observations	**ESCO process**	**SO new process**
1	• At times, due to the workload, the M&V teams cannot go to site to conduct baseline measurements as planned. • The cost of the M&V meters compared to project size could also be costly.	• Due to the accuracy of the information and database from the PD, the M&V team was able to develop the baseline timeously.
2	• Baseline developments could take up to 3 months depending on the technology	• Suggested time to develop baseline is up to 6 weeks.

7.3 Critical controls

Once the baseline had been developed, the PM ensured the baseline was signed off by the PD, IDM and the M&V entity respectively. This is a key step, as future savings will be compared to the baseline.

Step 8: PD signs SO contract (Activity flow L)

(Suggested time to sign SO contract - 1 week, actual time spent 1 week)

On approval of the baseline, the PM prepared the SO contract for signatures. The PM had to populate the SO contract, by completing the following required fields:

- PD details.
- Site details of the stores.
- Details of the approved technology.
- Minimum kWh savings.
- Duration of contract.
- Domicile address of both Eskom and the PD.

On completion of the above, the PD was sent a copy of the SO contract for signatures. The PD signed the contract on the 07 November 2012 and thereafter the authorised person in IDM signed the contract on the 13 November 2012

8.1 Key observations on activity L

At first, the PD requested clarity on many clauses in the contract, especially on the liabilities and obligations of the parties, the PD engaged the PM who provided the necessary clarity. The PM was well versed in the contract and did not require legal support to provide clarity to the PD. The PD was then comfortable to sign the SO contract. The suggested time to complete this process step was 1 week. The PM populated the contract in one day. The signing of the contract by the PD was done 2 days after the baseline was signed off. The contract had to be couriered back to Eskom Head Office; hence IDM received and signed the contract on the 13 November 2012.

8.2 *Comparing the SO process against the ESCO process for activity L*

In comparison to the ESCO process, the time taken to conclude and sign a SO contract with the PD was significantly reduced. Table 5-13 explains some of the reasons for this.

Table 5-14: Comparison between the ESCO and SO process for activity L

Contract		
Observations	**ESCO Process**	**SO process**
1	• The NEC penalties do not encourage over performance on projects. The NEC is designed to penalise the ESCO for underperformance and not reward over performance.	• The SO contract encourages over performance of 10%. Incentives are paid for over performance.
2	• The DSM Agreement which has to be signed between Eskom and the customer is onerous and lengthy, thereby requiring in-depth discussions between the Eskom legal department and the Customer.	• The SO contract was simple to understand. • The PD clearly understood that the contract is performance based and no savings equals no payment.
3	• Turnaround times of up to 15 months were reported in signing the DSM agreement.	• Signing of the SO contract could take up to 1 week.

8.3 ***Critical controls for activity L***

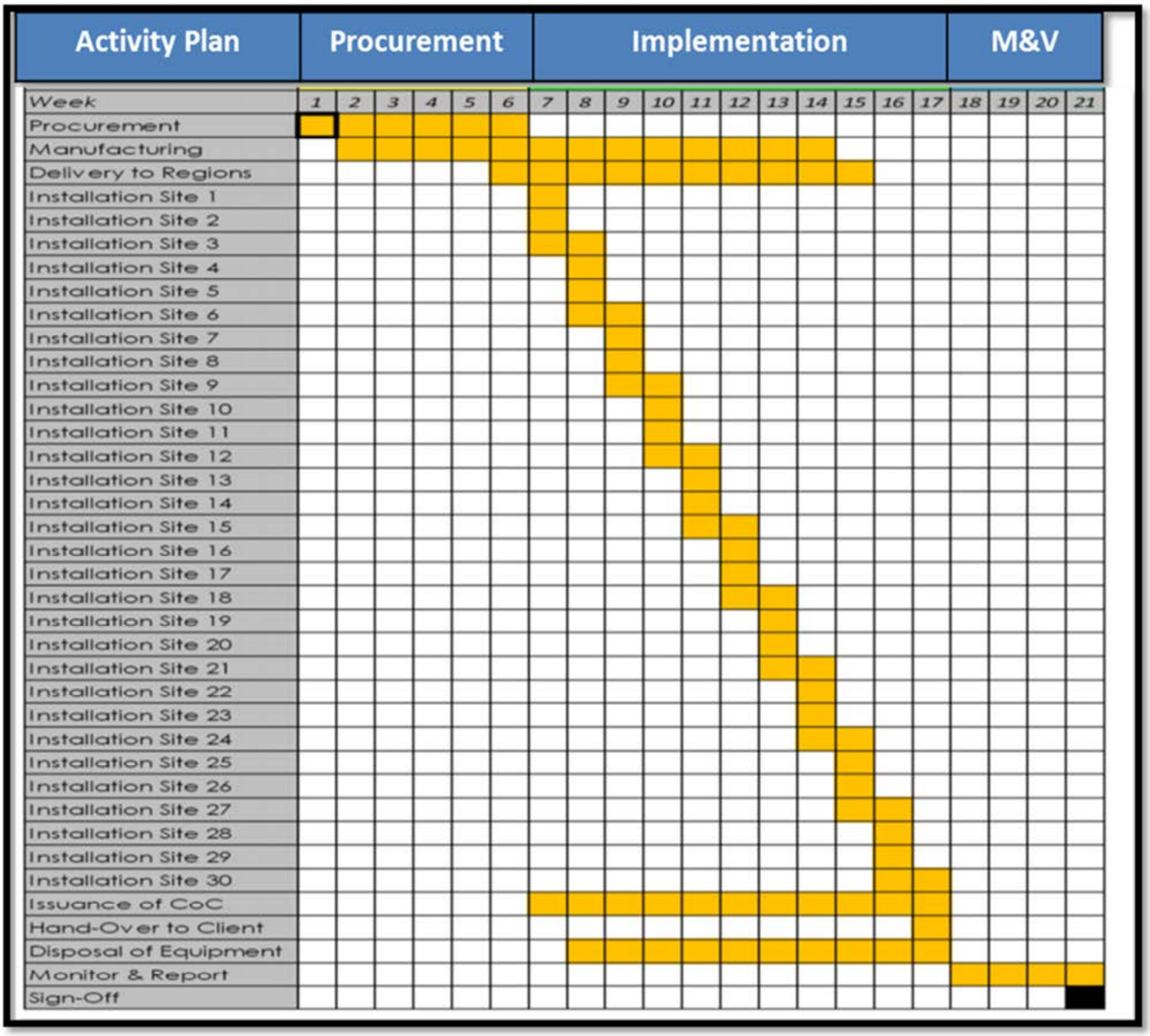
The PM has to ensure the SO contract is signed between an authorised person in IDM and the PD; thereafter 2 copies of the contract are made, one for the PM file and the other for the PD.

Step 9: Project implementation (Activity flow M)

(Suggested time to implement project - 6 months, actual time spent - 4 months)

Upon signing the SO contract the PM instructed the PD to start with the project implementation. The PD submitted a project plan as per Table 5-15 to the PM detailing how the project would be implemented over a period of 4 months at 30 sites. The plan was accepted by the PM and the project implementation started on the 01 December 2012. Due to the holiday season during December, most of the project work to assemble the new light fittings was done off site.

Table 5-15: Project Plan



In week 1, the PD procured all the components and material related to the project. In week 2 the manufacturing of the new light fittings began. By week 6 the new fittings were delivered to the various stores as needed. Once the new light fittings arrived on site, the old fittings were removed and replaced with the new fittings over a period of 2 days. Disposal of the old fittings was done in parallel 2 weeks into the implementation cycle. The project completion certificate was signed off on the 16 April 2013.

9.1 Key observations on activity M:

During the installation phase the PD submitted regular progress reports to the PM. Towards the end of the implementation the PD reported a delay in progress, due to the Customers contractor having to prioritise the construction of a new store for the Customer. The PD acted fast and used his own team to complete the last phase of the project. The implementation was then completed within the contract period. The quicker the installation the quicker the energy savings could be achieved, the quicker the PD could claim the incentives from IDM.

The time proposed by IDM to complete project installation was 6 months. The PD completed the implementation in four months.

9.2 *Comparing the SO process against the ESCO process*

With the ESCO process, project implementation could take up to 2 years to complete due to the complexity of the project and working conditions at the project sites (Figure 5-16). The ESCO process also allows for project implementation greater than 6 months. With the SO process the PD is informed upfront that the project must be completed within 6 months due to the urgent need to reduce electrical demand in SA.

Table 5-16: Comparing SO process to ESCO process

Project implementation		
Observations	**ESCO process**	**SO process**
1	• Customers make internal changes to the facility as they not willing to wait a long time for approval from IDM. This affects the ESCOs baseline negatively, which impacts the EE savings negatively.	• Customers are willing to wait a short time for funding from IDM to implement EE projects, hence they do not implement EE measures on their own accord.
2	• Time to implement projects could be as long as two years depending of the technology and site conditions.	• Suggested time to implement project up to 6 months.

9.3 *Critical controls for activity M*

The PM instructed the PD to submit regular progress reports on the project. The reports had to highlight potential site risks and challenges. The PM also requested early warning notification from the PD if the project was not going according to plan.

Step 10: PD disposes of old technology (Activity flow N)

(Suggested time to dispose old technology - 2 week, actual time spent 1 week)

Whist the project was in the implementation phase, the PD began disposing of the old technology, (light fittings) from the completed project sites. The PD used an external company to dispose of the old light fittings. Over 13000 fittings were disposed of in two batches. An independent disposal certificate was signed thereafter.

10.1 Key observations on activity flow N

The SO process allows the PD to dispose of old technology; the PD appointed an external company to dispose the old technology. Concerns were raised by M&V that there were no controls in place for IDM to validate the credibility of the disposal company. In future the SO process should include a step to validate potential disposal companies.

10.2 *Comparing the SO process against the ESCO process*

The comparison between the SO and ESCO process is shown in Table 5-17.

Table 5-17: Comparing SO process to ESCO process for activity N

Project implementation		
Observations	**ESCO process**	**SO process**
1	• IDM is responsible to appoint a disposal company to dispose of old technology. Often due to the commercial process, the disposal company is not appointed timeously; hence the old technology is not collected from the customer's facility. This then becomes a health and safety issue.	• The PD is responsible for disposing of old technology. Knowing this upfront, the PD will appoint a disposal company to remove the old technology from the customer site thereby mitigating possible health and safety risks.

Critical Controls for activity N

The PM had to ensure the old technology was disposed of in accordance with the requirements of the Hazardous Substances Act no. 15 of 1973, Environmental Conservation Act no. 73 of 1989 and regulations of the Department of Water Affairs and Forestry, and in terms of any additional applicable legislation.

Step 11: Post Measure Acceptance Period (Activity flow 0)

(Suggested time to measure post performance - 6 weeks, actual time spent - 4 weeks)

Following on project completion on the 16 April 2013, the M&V team conducted a post implementation site visit on 30 April 2013, to determine whether the EEDSM project had been implemented as originally intended. The M&V team performed a walkthrough of the various stores under the guidance of the PD. The team was able to see the newly installed light fixtures and was therefore satisfied with the implementation of the project. The team thereafter produced a post implementation report which contained the original system description, the proposed EEDSM measure, information on the actual installation on site and any deviations from the intended plan. The post implementation report was signed by the team on 06 May 2013. Thereafter the team started with the post measure acceptance period, which covered the period from 01 May to 31 May 2013 in accordance with SA National Standards (SANS) 50010:2011.

11.1 Key observations

Figure 5-3 compares the measured baseline to the actual weekday performance recorded during the MAP. Based on the actual savings, it is clear that the project is reducing electrical load as intended.

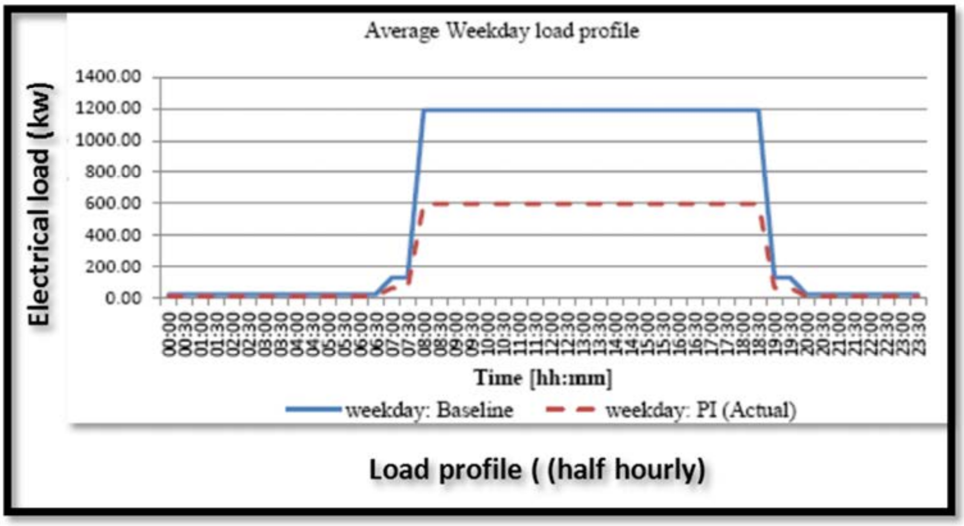


Figure 5-3: Actual project performance in comparison to the baseline

11.2 Critical controls for activity O

The PM had to check for variables that could affect the verified savings negatively; often due to seasonality and Customer production patterns during the year, the project performance could vary. Projects might underperform during the verification of savings in the first month of performance, but will then catch up during the course of the year to ensure the yearly average performance is achieved. In this project, the savings remained constant despite seasonal changes; hence the performance assessment report was signed off by the M&V team on the 01 June 2013 followed by the performance assessment certificate, which was signed on the 04 June 2013.

11.3 Comparing ESCO process to SO for activity O

No comparison was made between the processes as the M&V team used the same guidelines for both processes.

Step 12 PD submits first invoice for payment (activity flow P)

Based on the successful implementation of the project and good energy savings achieved during the MAP the PM instructed the PD to submit the first invoice to IDM for payment based on the independent PA report. As per the rules of the SO programme, the PD submitted an invoice for 70% of the contract value on the 12 June 2013. The PM processed the invoice and thereafter submitted the invoice to the finance department for payment to be made to the PD.

12.1 Key observation on activity P

Unfortunately the invoice was not paid within 30 days as per the SOP rules. This was due to Eskom having adopted a new financial system; hence the project administrators needed training and access to operate the new system prior to processing invoices.

12.2 Comparison with the ESCO process

No comparison was made between the processes as the financial administrator at Eskom use the same system to process invoices irrespective of the funding type.

12.3 Critical controls

The PM had to ensure that the invoice submitted was based on the performance assessment report and was within the contract condition.

Step 13: Annual M&V assessment over 3 year sustainability period (Activity Q)

Over the next three years during the sustainability period, annual invoices together with the M&V performance acceptance reports will be submitted to IDM. In the sustainability period, the first performance payment (10%) will be made 12 months from the Measure Acceptance Date (MAD). The MAD is the date when all parties sign and accept the project performance. The second performance payment (10%) will be made 24 months from MAD. The third performance payment (10%) will be made 36 months from MAD.

13.1 Key observation

The project is currently in its first year of the sustainability period; hence no key findings can be reported at present.

5.2. DISCUSSION

The new SO process was applied to a large commercial facility in SA to validate the:

- Approval turnaround time lines from submission to execution of the project.
- Process effectiveness in comparison to the ESCO process.
- Critical controls of each activity.

For purposes of the discussion the focus will be on the approval turnaround time from the point where the PD marketed the SOP to obtain a LOI from the Customer (activity F1) through to project execution and completion (activity P). Table 5-18 summarises and compares the activities of the suggested SO process timelines against the actual case study timelines.

Although IDM does not have full control over **Phase 1** (DSM investigation), these activities were completed well within the suggested SO turnaround time of 7 weeks. Similar activities in the ESCO process could take between 3 to 6 months to complete. In discussions with the PD, the reason for the improved turnaround time was attributed to:

- The SO process being an easy sell to the Customer, therefore obtaining a LOI was not difficult.
- The SO process is transparent and was well understood by both the PD and the Customer.
- The Customer contributed significantly by appointing a dedicated energy manager at head office to assist the PD to gather project information from the stores.
- The Customer implemented an energy management policy for the group, which called for a reduction in operating expenditure and greenhouse gas emissions.

Phase 2 entails the evaluation of the project by IDM. In this phase the suggested time to evaluate the project using the SO process is 7.5 weeks. The PD submitted the project to IDM on the 17 August 2012. The actual time spent on phase 2 (IDM evaluation) was 6 weeks. This is a large improvement when compared to the ESCO process, which could take between 6 to 12 months to complete. The remarkable turnaround time as indicated by IDM staff was attributed to:

- The project registration template being clear, transparent and easy to understand.
- The new SO templates developed for TEC evaluation prompted and guided the PM to look for key information in the project proposal; thereby reducing the administrative burden on the PM.
- A quality submission from the PD.
- The PM complying with the templates, checklist and requirements of TEC.
- The new SO project checklist (Annexure A), was shared with the PD upfront. By following the checklist the PD and the PM knew exactly what was required by TEC.
- The PEC chairman holding PEC meetings at least once a week.

Table 5-18: Comparison of the suggested timeline with the case study

Phases	Activities	New SO process	Case study
Phase 1	***Activity***	***Suggested time to complete activity F1 and F2***	***Actual time spent on activity F1 and F2***
DSM investigation	F1 - PD markets SO to obtain Letter of Intent (LOI) from customer F2 – PD formulates project submission to IDM	7 weeks	5 weeks
Phase 2	***Activity***	***Suggested time to complete activity G to K1***	***Actual time spent on activity G to K1***
Evaluation by IDM	G- PD registers as a vendor with Eskom H- Project screening and registration by PM I – Assessment and approval of project by TEC J – PEC approval of project K 1- PM request M&V to develop project baseline	7.5 weeks	6 weeks
Phase 3	***Activity***	***Suggested time to complete activity K2***	***Actual time spent on activity K2***
Develop project baseline	K2 -M&V to develop project baseline to determine “as is” operation of the facility	6 weeks	4 weeks
Phase 4	***Activity***	***Suggested time to complete activity L***	***Actual time spent on activity L***
Contracting	L - PD signs SO contract with IDM	1 weeks	1 week
Phase 5	***Activity***	***Suggested time to complete activity M and N***	***Actual time spent on activity M&N***
Implementation	M – PD implements project as per the terms of the SO contract N – PD disposes of old technology	Up to 6 months	4 months
Phase 6	***Activity***	***Suggested time to complete activity O and P***	***Actual time spent on activity O and P***
Performance assessment & maintenance	O – Post measure acceptance period performed by M&V P – Project sign off and first invoice submitted for payment by the PD	6 weeks	6 weeks

Phase 3 entails the development of the project baseline. This phase is performed by M&V. The request to the M&V team was submitted on the 5th October 2012. According to the team, the estimated time to set a baseline is 6 weeks; however the actual time spent on setting the baseline was 4 weeks. The baseline was completed and signed on the 5th November 2012. This was a remarkable achievement by the M&V entity. The quick turnaround time was due to credible data being made available to the M&V team upfront. The PD and the Customer also played a key part in the M&V process by ensuring information was readily available with easy access to site stores.

Phase 4 entails the signing of the SO contract between IDM and the PD. The suggested time to complete this phase is 1 week as the contract terms and conditions are standard. The signing of the contract by the PD was done 2 days after the baseline was signed off and thereafter couriered to Eskom head office for signature. Overall the contract was signed between the PD and Eskom within a week. This is a large improvement when compared to the ESCO process, which could take between 6 to 12 months to sign a contract.

Phase 5 entails the actual implementation of the project. The suggested time to complete this phase using the SO process is 6 months due to the urgent need for energy savings. The PD completed the implementation and disposed of the old light fittings within four months. Disposal of the old fittings was done in parallel to implementation. The project completion certificate was signed off on the 16 April 2012.

Phase 6 entails the post measure acceptance period. Following on project completion on the 16 April 2013, the M&V team conducted a post implementation site visit on 30 April 2013 to determine whether the EEDSM project had been implemented as originally intended; thereafter the team started with the post measurements, which covered the period from 01 May to 31 May 2013. Based on the actual savings achieved it is clear the project was reducing load as intended, proving the project is a huge success. The performance assessment report was signed off by the M&V team on 01 June 2013 followed by the performance assessment certificate, which was signed on the 04 June 2013. As per the rules of the SO programme, the PD submitted an invoice for 70% of the contract value on the 12 June 2013.

5.3. CONCLUSION

The case study demonstrates the new SO process significantly reduces the overall time from project submission to execution when compared to the ESCO process. The timelines suggested for IDM to evaluate projects (phase 2) and conclude the SO contract with the PD (phase 4) was predetermined to take 8.5 weeks. The similar phases in the ESCO process could take up 15 months to evaluate. From the case study the evaluation of phase 2 and 4 by IDM has taken 6.5 weeks, hence the predetermined evaluation time is considered to be reasonable. Although IDM does not have direct control over phase 1, 3, 5 and 6 the case study has shown positive time improvements being made in these phases.

Chapter 6

6. CONCLUSION

6.1. OVERVIEW

The South African electrical power system is currently constraint. This is due to Eskom's aging power stations requiring increased maintenance in the summer and winter months. Also, levels of unplanned maintenance at various power stations are increasing sharply. And the delays in construction of new power stations could lead to negative economic growth and added pressure on the existing power system.

Although the DSM programme has significantly contributed to lowering the demand in SA by 3076 MW from 2004 to the end of financial year 2012 (10), more energy efficiency interventions are urgently needed between the power supply constraint periods of 6.00 am to 10.00 pm, Monday to Friday. These interventions will contribute towards keeping the lights on in South Africa and will create much needed space for power station maintenance.

The literature survey in Chapter 2 has shown there is still an opportunity for EEDSM in SA and the rest of the world, especially in the commercial and industrial sectors. The potential for EEDSM in SA, ranges from 2000 MW up to 4000 MW (12). The market penetration will be dependent on overcoming barriers to EEDSM and simplifying the current ESCO funding process, which takes up to 15 months for approval of a good EE project.

To overcome these challenges and to unlock the market potential, an international scan was performed in Chapter 3 to investigate possible solutions to approving EEDSM projects in SA. One of the solutions to reduce the overall time from application to execution was the introduction of the Standard Offer (SO) process. Global research shows other countries have implemented SO successfully; however, in the case of SA the SO process as adopted internationally could not be used in its current form; hence a new SO process was developed based on a hybrid of the ESCO funding process and international best practise.

Chapter 4 entails the development of the new SO process in line with the Systems Thinking Approach (STA), to solve complex situations and Eskom's Project Life Cycle Model (PLCM). The new SO process that will form part of IDM's processes for evaluating EEDSM projects was developed to increase market uptake for EEDSM, reduce the burden on IDM staff, improve the time taken to evaluate EEDSM projects and reduce Eskom's risk by making performance based payments to the PD.

Once the SOP was developed it was then tested on a large commercial retail facility in SA, to determine the effectiveness of the new process in relation to the time taken to evaluate and approve EEDSM projects as compared to the ESCO process. The effectiveness of the critical controls was also tested.

6.2. MARKET RESPONSE TO SO IN SA

The launch of SOP was well received by stakeholders involved in the programme. The SO concept spread fast to both commercial and industrial sectors. The programme attracted large commercial, 'blue chip' property groups that were keen on becoming EE and reducing their carbon footprint and operational costs. Better working relationships began to evolve between customers, PDs and Eskom as the new SO process was transparent and well understood. Many customers congratulated IDM for initiating the programme and creating much needed jobs for SA by the use of PD.

Although IDM funding does not cover the full project cost of the SO initiative, customers are keen to participate on the programme due to short approval turn-around times, which lead to quicker energy savings resulting in quicker operational cost savings. These cost savings generated will be used to off-set the shortfall in IDM funding, thereby reducing pay back periods significantly. In other instances, many PDs offer a no cost energy saving solution to the customer in return for a signed LOI and a percentage of the profits as a result of the energy saving project.

Many PDs sell the SO concept in phases to customers; they first start with the lighting projects and then move on to other technologies such as HVAC, compressed air and renewable energy systems.

The main reason for this is to limit the upfront marketing and audit costs. On successful completion of the first project, many Customers use the same PD to investigate other opportunities.

The SOP has succeeded in increasing the market uptake for EEDSM projects. Many service providers, ranging from lighting suppliers to heavy mining engineering companies, have participated in the programme to the extent the initial SOP pilot programme budget of R30 million had to be increased to R500 million to cater for the influx of projects received by IDM.

As per Figure 6-1, 349 projects were submitted to IDM from 01 April 2012 to 25 October 2013 (39). The proposed demand and energy savings of these projects are equivalent to 141 MW and 590 GWh respectively. April, May and June 2013 saw a slow start to the SOP, which can be attributed to the initial marketing of the programme by both IDM and the PD in the first 3 months; thereafter project submissions started to steadily increase.

The total costs of the projects submitted to IDM amount to R 740 million against a SOP budget of R 500 million. This is indicative of a strong market uptake for SOP. Fortunately for IDM, project acceptance is only done after approval by PEC, therefore PEC must commit funds up to R 500 million and thereafter request further funds to accommodate the balance of the projects and future projects.

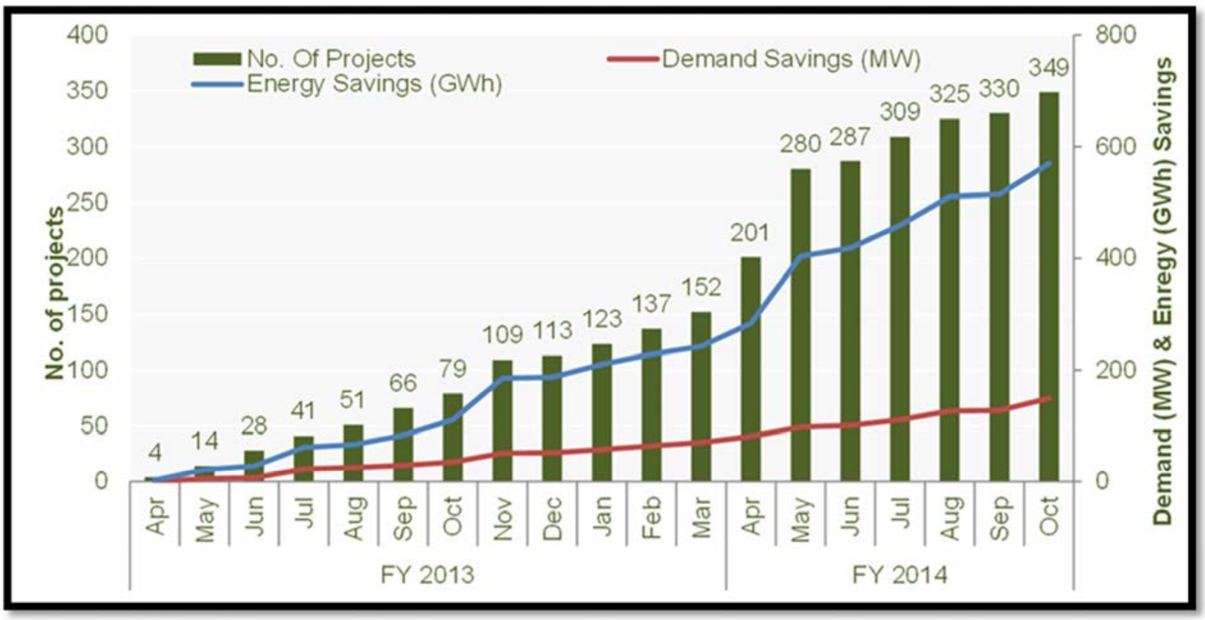


Figure 6-1: Market response to the SO programme (39)

The status of the projects submitted to IDM under SOP can be seen in Table 6-1. The table shows 349 projects were received by IDM from 01 April 2012 to 25 October 2013 of which:

- 72 Projects have been verified, resulting in a demand saving of 22 MW and EE savings of 137 GWh.
- 10 projects are currently in the verification phase, (measure acceptance period) of the process, which will contribute 6 MW of demand savings and 24 GWh of energy savings.
- 60 projects are in the implementation phase, which will result in a demand saving of 47 MW and energy savings of 166 GWh on completion and verification.
- 51 projects are in the contracting phase, which will contribute to a savings of 21 MW and 77 GWh respectively on completion and verification.
- 1 project at PEC for evaluation with a proposed demand savings of 0.5 MW and energy savings of 1.8 GWh.
- 155 Projects have recently been submitted to IDM with a proposed demand and energy savings of 44 MW and 184 GWh respectively. These projects are currently undergoing project screening, registration and technical evaluations.

Table 6-1: SO project pipeline

Project Pipeline phases (Status)	Number of projects	Demand savings (MW)	Energy Savings (GWh)	Sector
Verified	72	22	137	I&C
Verification	10	6	24	I&C
Implementation	60	47	166	I&C
Contracting	51	21	77	I&C
PEC	1	0.5	1.8	I&C
Recently submitted proposals	155	44	184	I&C
Total	349	141	590	

Thus far from a technology perspective, lighting and HVAC technologies make up the bulk of the projects submitted, followed by renewable energy technologies. PD have indicated that SO works best in situations where customers are planning to replace or retrofit old technologies as part of their maintenance cycle.

6.3. RECOMMENDATION FOR FUTURE WORK

Due to the overshoot in the SOP budget, a better tracking mechanism needs to be developed to capture project submissions from PD that are submitted via head office and regional IDM offices. A web based portal is needed to create a single point of entry for all projects submitted to IDM. In addition GPS co-ordinates of the project sites that participate in the SOP need to be captured, this will avoid duplication of project submissions by the PD. Sharing of information via the internet must be set up to inform the PD which sites have participated in the SO programme already. This will avoid unnecessary phone calls and travel to potential customers by the PD in the marketing phase of the SOP.

Other sources of funding, such as government tax incentives, low interest bank loans, carbon offset funding need to be explored to complement the current SOP funding for even greater uptake on the programme.

The current SOP caters mainly for the retrofitting of existing facilities with limited focus on new facilities; this is due to existing facilities having a credible baseline that can be used to determine current energy consumption. Future work needs to focus on a methodology to determine an acceptable mechanism for what a new facility baseline would be without any EE intervention in order to qualify for SO funding.

Work is also needed in improving Supplier Development and Localisation (SD&L) in SA. The majority of EE technologies are imported into SA, hence financial incentives need to be set aside for Suppliers and Developers that manufacture EE technologies in SA.

6.4. FINAL CONCLUDING REMARKS

It was proven through implementation that the new SO process is successful in:

- Increasing the market uptake for EE projects in the I&C sector.
- Streamlining the funding approval process by IDM.
- Reducing the burden on Eskom staff.
- Reducing Eskom's risk by making the payments to PD based on performance only.

Both Customers and PDs have expressed appreciation to IDM for providing the Industry with an alternative funding model that is transparent and simple to understand.

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8. APPENDIX

8.1. ANNEXURE A: SO CHECKLIST DEVELOPED FOR TEC EVALUATION

Part	DETAILS/DESCRIPTION				
A	**[PART A: GENERAL PROJECT INFORMATION]**				
1.	Name of the project manager				
2.	IDM Sector				
3.	Name of the project				
4.	DSM Database Number				
5.	What is the proposed demand savings (kW)				
6.	What is the proposed energy savings (kWh)				
7.	What is the Project Load factor?				
8.	Are the before and after load profiles included in the proposal and excel spread sheet provided				
9.	Project type	EE	LM	RLM	
10.	Funding model				
11.	Rm/MW or c/kWh (benchmark)				
12.	Rm/MW or c/kWh (project)				
13.	Total project cost (R)				
14.	Technology to be installed				
15.	Project implementation period				
16.	Short summary of project – How are savings achieved?				
17.	Are the PDs name, contact details, and physical address in the proposal?	Yes		No	
18.	Has the PD been registered i.e. do they have a vendor no?	Yes		No	
19.	Is the PDs background included in the proposal?	Yes		No	
20.	Are the Customer name, contact details, and physical address in the proposal?	Yes		No	
21.	Is the Customer's background included in the	Yes		No	

	proposal?				
22.	Has the client/customer signed off on the proposal?	Yes		No	
23.	Is the Letter of Intent (LOI) submitted and signed by the client/customer?	Yes		No	
24.	Has the customer agreed to pay the top-up (the excess amount not paid by Eskom – if any)?	Yes		No	
25.	Are all parties involved (PDs, Customer, sub-contractors, etc.) aware of : • Agreement provisions • M&V guidelines • Need to have M&V plan and baseline buy-in before implementation M&V's need to access the site and stakeholders directly?	Yes		No	
26.	Is the scope of work clearly described (this must include a schematic diagram if applicable)?	Yes		No	
27.	Has the PD been informed that a Project Quality Plan (PQP) must be submitted before contracting?	Yes		No	
28.	Has the PD submitted a SHE/SHEQ Plan?	Yes		No	
29.	Are there any current existing DSM project/s on the site?	Yes		No	
30.	What is the performance of the old project (as per M&V)?				

	[PART B: TECHNICAL INFORMATION]				
	TECHNICAL INFORMATION	**YES**	**NO**	**N/A**	**DETALS/COMMENTS**
31	Is the current existing technology well described?				
32	Is the description of the proposed technology clearly described (including supplier specifications)?				
33	Are the proposed technologies correctly split (e.g. lighting and sensors, plant upgrades etc.)? Proposed technologies should not be presented in a consolidated manner.				
34	Does the proposed solution increase production (i.e. give the client a competitive edge)?				
35	Is the proposed profile based on actual measured or manufacturer specifications?				
36	Are the before and after load profiles included in				

	the proposal and presentation (The plots must be MW/kWh vs. half hourly/hourly for weekday, Saturday, Sunday)?				
37	Is the methodology for the establishment of the savings (Energy and Demand) included in the proposal (required later by M&V)?				
38	Are the variables that could affect the savings included (e.g. production increase, seasonal variations, time of usage etc.)?				
39	If a demand shift is being proposed, is it energy neutral? Give the reason for the shift during the specific period of day, use of shifting etc.				
40	If the project type is LM, what other DSM options have been considered, (can the equipment/ process be used for energy efficiency. (e.g. compressor to run continuously with a higher efficiency as opposed to only being switched off during peak periods)?				
	[PART C: REQUIREMENTS FOR SPECIFIC TECHNOLOGIES]				
	Lighting Technology				
41	What type of ballast/lamp will be used and is it suitable for the environment in which it will be used? (e.g. Down lighters used in University halls) Provide details such as manufacturer, product code, photometrics and LOA				
42	What are the existing and proposed lamp lumens (lm)?		Existing		
			Proposed:		
43	What are the existing and proposed lux levels (lx)?		Existing:		
			Proposed:		
44	What is the existing and proposed lamp power (Wattage)?		Existing:		
			Proposed:		
45	What is the existing and proposed lamp lumen depreciation?		Existing:		
			Proposed:		
46	What is the colour rendering index (CRI)?				
47	What is the mercury content of the proposed lights?				
48	What is the existing and proposed lamp Efficacy (l/m)?		Existing:		
			Proposed:		
49	What is the proposed lamp economical life?		Proposed:		

		Yes	No	N/A	DETAILS/ COMMENTS
50	Are all the standards upheld and not compromised in terms of the lighting fixtures? (i.e. Mining Act Regulations, OHS Act etc.)?				
51	Are the installers licenced with CIDB?				
52	Are there disposal costs involved? If so how will the disposal of the old technology be done.				
53	Is the PD aware that an independent party will be required for disposals and that disposal certificates are required to be sent/ copied to M&V teams?				
54	What are the factors that could negatively impact the lamp life (e.g. sensors)?				
55	If there are sensors, are separate profiles included in the proposal?				
[PART D: INFORMATION REQUIRED FOR PEC]					

D	INFORMATION REQUIRED FOR PEC	YES	NO	N/A	DETAILS/COMMENTS
56	Decision Required				
57	ESCO/Project developer's background				
58	Customer's background				
59	Letter of Intent				
60	Scope of work (also to include all the relevant information stated in Table 3 and)				
61	Technology overview				
62	Schematic diagram				
63	Load profiles				
64	Load reduction calculation				
65	Capped value calculation				
66	Finance				
67	Environmental issues				
68	Risks and mitigation				
69	Employment/job opportunities				
70	Decision Required				

E	**[PART E: MEASUREMENT & VERIFICATION (M&V)]**				
71	Is the M&V request for this project ready for submission?	Yes		No	