The use of the ESCOs to facilitate sustainable energy interventions in the low income housing sector

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1. Background to Energy Service Companies (ESCOs)

1.1 Introduction

Access to energy is a pre-requisite for development. Whether at the macro level of countries and governments, or at the micro-scale of a household, economic activity can only be sustained with access to energy.

In low income households there is often severe energy poverty. Houses are typically poorly insulated against cold, meaning households have bigger need for energy whilst lacking the resources to acquire it. Low income households are often very reliant on fossil-fuels and wood to heat water, food or their houses. These fuels are usually more expensive than electricity, consume more effort to acquire and can have other negative implications. Well-known side-effects of paraffin and wood fires in houses are respiratory diseases, carbon-dioxide related deaths and fires. One can therefore observe that low income households are partly kept in poverty because they need more energy, pay a higher total price for energy, while they lack the ability to escape their level of poverty.

If it was possible to assist low income households to insulate their houses better and gain access to renewable energy sources, one would be able to break the spiral of energy poverty. However, such interventions are too expensive for these households to consider without external financing support, and the need for up-front payments is problematic.

Making use of energy service companies (ESCOs) can overcome the obstacle of upfront costs to bring previously unavailable services to low income households, while also delivering a number of other benefits to society. Furthermore, ESCOs are ideal vehicles to drive access to different income sources at a project level, as ESCOs are incentivised to return a profit. However, there are a number of obstacles and issues that must be addressed before ESCOs can be used effectively.

This paper explores how ESCOs may be incorporated into a model for the introduction of Energy efficiency (EE) and Renewable Energy (RE) initiatives in poor communities on a large scale. Section 1 explores ESCOs in a general context, while section 2 will give an overview of ESCOs in South Africa in terms of history and profile. Section 3 elaborates on the role that ESCOs in South Africa could play in the low-income housing sector, specifically looking at barriers and enablers for sustainable energy projects. Section 4 concludes the paper by summarising the benefits of using ESCOs.

1.2. ESCOs and their clients

ESCOs provide energy services that could come in many forms, but in most cases involve delivering conventional energy, RE, EE or load management interventions to facilities owned by a client. Doing so could involve energy audit services, financing mechanisms, equipment procurement, installation and commissioning, operation monitoring and performance guarantees" (Department of Minerals and Energy, 2005). ESCOs offer the most value to entities that do not understand their energy bill, are not aware that they waste energy, or do not understand their energy consumption and where opportunities exist for savings.

Being an ESCO does not disqualify a business from any other description and, given the wide spectrum of services that fall within the definition of energy services, it is not surprising to find a variety of entities calling themselves ESCOs. These could include:

- Electricity and fuel suppliers,
- Manufacturers of RE or EE technologies,
- Distributors of RE, EE and other equipment,
- Different types of engineering enterprises,
- Construction businesses,
- Energy efficiency specialists, and
- Energy consultants.

Clients of ESCOs can be any entity that would like to explore possible savings to its energy costs, and could range from large industrial companies to municipalities, or could even be as small as individual households within communities. In cases where energy services are delivered to a company, a community or a region, a concession - or contract granting the right to operate a business - can be awarded by the public body responsible for the energy service delivery. The concession limits the number of service providers and therefore reduces the market demand risk to the ESCO.

Client density may therefore differ and it has important implications for service companies. Smaller ESCOs dealing with small municipalities may require that service points (i.e. streetlamps or households within the municipal area) are close to one another. Especially when dealing with a community project, the issue of density of clients may be important. The transaction cost of doing business increases as the project gains in geographic size.

For larger ESCOs there may be less need for geographic proximity as economies of scale counteract transaction costs. Many of the costs of ESCOs are upfront fixed costs, financed from debt (banks loans), equity (from the owners or from venture capitalists) or retained earnings. The marginal cost of additional clients is relatively small[1].

1.2 ESCOs internationally

Although Compagie Generale de Chauffe (loosely translated as General Heating Company) initiated the first energy performance contracting in France more than 100 years ago, the first ESCO industries only appeared in most developed countries during the late 1970s and early 1980s (Vine, 2005: 692). The majority of ESCO activity only took place in the nineties. ESCOs have not been prominent in South Africa until very late in the 1990s.

Few ESCOs operate on a multinational level but examples do exist of very successful multinational players. Compagie Generale de Chauffe operated in 20 countries and employed 28 000 people, and was acquired by Compagnie Générale des Eaux in 1981 (who became know as Vivendi in 1998), who then became the biggest energy service company in France. Vivendi Environment was spun off from the bigger group in 2002 and became know as Veolia Environment in 2003. (Veolia Environment, 2006)

In developing countries ESCOs have been successfully used to bring energy services to the poor. In Argentina a concession approach was followed for rural electrification (Reiche, Covarrubias & Martinot, 2000: 57). Martinot and McDoom (2000: 54) use an example of solar heating services (SHS) to illustrate the use of ESCOs for EE and RE measures at a domestic level. In 1997 the World Bank and the Global Environment Facility invested a total of $120 million in an ESCO delivery mechanism to bring solar heating systems to 108 000 households in Argentina. Other examples of ESCOs in developing countries are shown in the table below.

Table 1.1 Examples of ESCOs in developing countries

Country	Description
Argentina*	The government awarded concessions for each of ten provinces based on a competitive selection process
Benin*	Concessions were awarded for fifteen years based on competitive selection.
Togo*	Concessions were awarded for fifteen years based on competitive selection.
Peru*	Concessions were established in four separate regions based upon Peru's existing Electrification Law. Concessions in the Peru project did not have monopoly status.
China**	China Energy Conservation project created three ESCOs to demonstrate energy performance contracting. These ESCOs were expected to identify, finance and implement projects. The ESCO carried the finance and technological (performance) risk. Ownership reverted to the host enterprise once the ESCO's costs and a reasonable profit were recouped.

[1] Exactly how current ESCOs are financed and the exact split between fixed and marginal costs may point to future areas for research.

Brazil**	The project in Brazil created demonstration ESCOs to implement performance contracts and also created a credit facility from commercial or development banks to encourage financing of ESCO projects

Source: *Martinot & McDoom (2000: 47), **Martinot & McDoom (2000: 74)

It is important to note that all of the projects listed by Martinot and McDoom (2000) in the table above were aimed at the industrial sector. Historically, ESCOs seldom serve small or residential customers due to extremely long sales cycles (up to 18 months) and the high transaction costs associated with the ESCO industry (Shippee, 1996: 82). The sales cycle refers both to the time it takes to secure a customer and the long payback periods evident for a large number of small projects.

ESCOs are particularly popular in Demand Side Management (DSM[2]) programs. DSM projects are often partly financed through financial incentives (e.g. a subsidy). Martinot and McDoom (2000: 75) mention the examples of Palestine, Egypt and Thailand, where DSM units of utilities were expected to turn over their activities to ESCOs once a market has reached critical mass.

There are usually three parties in DSM projects:

1. The utility company, acting as financier and approver of projects.
2. The ESCO, acting as agent to find project and apply for funding from the utility.
3. The client, owner of the facility/project.

1.3 Classification of ESCOs

ESCOs have been classified in several ways. Shippee (1996, 81) distinguishes between four different kinds. **Vendor ESCOs** do not operate in the DSM industry and tend to focus on large clients. This group falls outside the scope of this report. **Utility ESCOs** bid to serve as providers for utility funded DSM programs and are paid based on electricity savings. **Contractor ESCOs** typically work with contractors in greenfield construction projects by installing more energy efficient equipment than what might have been provided otherwise. **Engineering ESCOs** perform design and other services but are seldom involved in performance contracts.

ESCOs can also be classified by focusing on the markets they serve. In a study conducted in the UK, Hinnels and Rezessy (2006) used three broad markets to classify companies providing energy solutions. The objective of their paper was to identify opportunities and barriers to ESCOs operating in the industrial, community and household environments.

1.3.1 Industrial market

The biggest source of clients for ESCOs is the industrial sector, where ESCOs often assist companies in reducing costs, improving energy efficiency, managing risk and enhancing their competitive edge. These ESCOs often make use of the performance contract model (Hinnels and Rezessy, 2006: 1). The performance contract model retains large industrial customers on a long term supply contract and views energy services as a means for delivering engineering services or new equipment. This model is similar to Shippee's Vendor ESCOs (1996, 81) and is therefore not applicable to low income housing projects. Hence the performance contract model also falls outside the scope of this paper and will not be discussed in any further detail.

1.3.2 Community model

In the community model the energy service companies manage the design, implementation, finance and operation of community heating schemes, often as a partnership between a private sector company and a local authority or a new-build housing developer. (Hinnels and Rezessy, 2006: 1)

Hinnels and Rezessy (2006) do not provide much clarity over the nature of the community, and whether it refers to multiple households in a single building or whether this may include a number of households living in free standing houses, i.e. as is found in typical low income housing developments in South Africa.

ESCOs operate well in a community environment where it is possible to measure energy use at a central point. In Europe it is common to find central heating schemes operating in this model. It is

[2] DSM programs can be divided into four broad groups, namely strategic load growth; load shifting; interruptibility; and energy efficiency interventions. (See Acharya, 2001: 7&8 for more information).

harder to make the model work for many small households as the additional transaction costs can be substantial.

1.3.3 Household Market Model

The domestic/residential market hinges on the contracting of individual (existing) households. The major players in this market are utility companies, contractors or equipment manufacturers and suppliers.

This is the smallest group in the UK, possibly because of the high transaction costs associated with this type of model, which eat away at profitability. While industrial and group-based (community) contracts would typically require less time to administrate than household contracts, they would normally have a higher income. Household contracts require more collection agents (more so in lower income communities) and other types of employees, pushing up staff costs, while the administration also needs to be more sophisticated to deal with a larger number of contracts.

Another reason for reduced profitability is the nature of greenfields (new developments) versus brownfields (retrofit) projects. When considering the financial return of projects, retrofit projects suffer from inefficiencies. In industrial projects this may mean that existing machines must be removed for new energy efficient equipment. Such a project may also require other changes in a system, i.e. a new software package to control the machines.

In the household context it is more expensive to put in a ceiling or to insulate a ceiling after a house has been completed. However, an even bigger reduction in space heating expenses can be achieved if the house's orientation, window size and other factors can contribute to improved comfort levels. A second source of efficiencies in using an ESCO model in greenfields projects as opposed to retrofits, is that the client could be the project developer rather than individual homeowners, greatly reducing transaction costs.

1.4 The three typical ESCO business models

Depending on the type of market that the ESCO is targeting, it would make use of a financial model suitable in the specific circumstances, but in most cases it can finance RE and EE projects in three ways, namely *guaranteed savings, shared savings and Chauffage*.

In *guaranteed savings* projects, the customer finances the intervention. The customer therefore borrows money to implement the project, not the ESCO. The ESCO guarantees a certain level of savings and is paid a pre-agreed amount to do so.

ESCOs often use a *shared savings* model, where the ESCO is paid a percentage of the costs they save their client. Of course shared savings is an attractive payment method because of its win-win nature. This is particularly relevant for energy efficiency projects. In shared savings projects, the ESCO finances the investment. In such a case the ESCO takes on the performance risk as well as the credit risk.

The third method (termed *Chauffage* after Compagie Generale de Chauffe, one of the first ESCOs in the world that made use of this model) involves the sale of the energy service itself, i.e. lighting. In this case the ESCO not only takes on the cost of investment, but also the responsibility for maintenance and operations, providing support for the life of the concession.(World Energy Efficiency Association, 1999: 4-5) Another way to interpret this idea of energy service companies is based on the notion of selling a service rather than a product. Instead of buying an asset with limited life, of which the business has little knowledge, the asset is replaced with a service contract with another entity. The economic justification is that the provider of the service will render the service in the most efficient way. Selling hot water, heat or light, rather than a geyser, a ceiling or a light bulb is economically more efficient. When the cost saving is also to the benefit of the client, the model will be accepted in the market. In all three cases "regulation (of ESCOs) is probably unnecessary as the risk of non-delivery is carried by the ESCO". (Department of Minerals and Energy, 2005)

1.5 Financing of ESCO activities

1.5.1 Financing business growth

Financing is the biggest obstacle for ESCOs (World Energy Efficiency Association, 1999: 6; Vine, 2005: 694), but the financing needs of a particular ESCO is inevitably dependent on the business model it follows. While ESCOs in *guaranteed savings* model experiences its biggest need for capital at the establishment phase of the business, ESCOs operating in the *shared savings* or *Chauffage* model will require additional capital to finance working capital needs.

ESCOs have a choice between debt and equity when financing expansion, and in limited cases also have access to donor funding. Sources of debt and donor funding include governments, multilateral banks, and commercial financiers (Martinot & McDoom, 2000: 47). In turn, the most probable source of bank financing would be from the enterprise loan departments, although other divisions may also play a role in the model. These include commercial bank loans (that may finance the household's contribution) and corporate finance departments (in case the project makes use of project financing).

Most of the financing needed by ESCOs would be for capital investment, either for the ESCO itself or investments in an EE or RE project. Manufacturers and distributors of EE and RE equipment may be in a very good position to provide financing to the end-users. Providing financing will increase the demand for such equipment - leading to a significant opportunity for increased revenue.

However, given the nature of ESCOs, the debtor's book (and long debtor's cycle) will very quickly create a very highly indebted business. Unless banks understand the business model of ESCOs, the chances will be slim that the ESCOs will have sufficient access to bank financing.

For manufacturers to branch out into the ESCO market, the provision of credit needs to be thoroughly understood by potential parties or this can ultimately lead to the downfall of the manufacturing and distributing businesses. By separating manufacturers and ESCOs, the risk of a total collapse in the value chain can be managed more effectively, but it may be a less efficient model. More research should look at the possible synergy in combining the role of manufacturers with that of ESCOs.

1.5.2 Project Financing

Project financing does not rely on the financial strength of the developer of a project but rather relies on the cash flows of a project to determine its viability. It is an extremely flexible form of financing and can be custom made to suit the needs of various parties.

Because EE and RE projects in conjunction with various subsidies could potentially offer attractive returns, this would be an attractive method of financing. However, once again economies of scale may be a requirement as project financing requires extensive due diligence studies and may be expensive in legal fees.

The biggest attraction to project financing is that an ESCO (acting as project developer) will be protected from financial loss in case of non-performance/bankruptcy (assuming there was no negligence on the side of the ESCO).

The Special Purpose Vehicle (SPV) created in project finance can be a suitable entity to act as the owner and seller of innovative financial revenue streams, such as carbon credits or renewable energy certificates, and can accommodate any form of investor. In such a case the financial and performance risk is carried by the SPV. In many instances the SPV will rely on concessions to reduce market risk.

2. The ESCO industry in South Africa

2.1 Introduction

The first ESCO in South Africa was only established in 1998 and by 2002 the total number of ESCOs were fewer than six (Vine, 2005: 693). The industry became more formal in 2002 when the DSM fund was established within Eskom, the South African energy utility. There are currently 153 ESCOs registered with Eskom (Nyasheng, 2006), of which 140 are listed on the Eskom DSM website. (See Appendix A for a detailed breakdown of the ESCOs operating in the domestic and residential markets).

Additional ESCOs operate outside the DSM framework, although these are largely in start up and design phases.

2.2 Capacity

Eskom groups ESCOs in four markets, i.e. industrial, commercial[3], residential and domestic. Domestic services focus more at household level while residential services extend to community/municipality level. Vine (2005: 692) indicates that residential projects focus mainly on groups of people sharing a building (multi-family buildings), but this distinction generally does not exist in South Africa.

Each of these four groups typically offer a number of services in their particular market, while the market dictates what products or services are most suitable. These categories are fairly unpractical as it is often difficult to see them as mutually exclusive. ESCOs do sometimes operate in multiple market segments, but this is fairly uncommon.

Recent statistics by Eskom (2006) indicate broadly the extent of the progress made by ESCOs since the DSM initiative came into effect. The residential sector constitutes 35% of maximum demand (See Figure 2.1) and if one considers the number of DSM projects, then 27% of projects took place in the residential sector. However, what is not shown in Figure 2.1 is that the residential sector contributed only 5.4% of the total savings made in DSM projects. The Industrial and commercial markets respectively contributed 7.5 and 87.1 percent to the total savings measured in MWH. The available statistics do not describe the extent to which residential projects were delivered in low income communities.

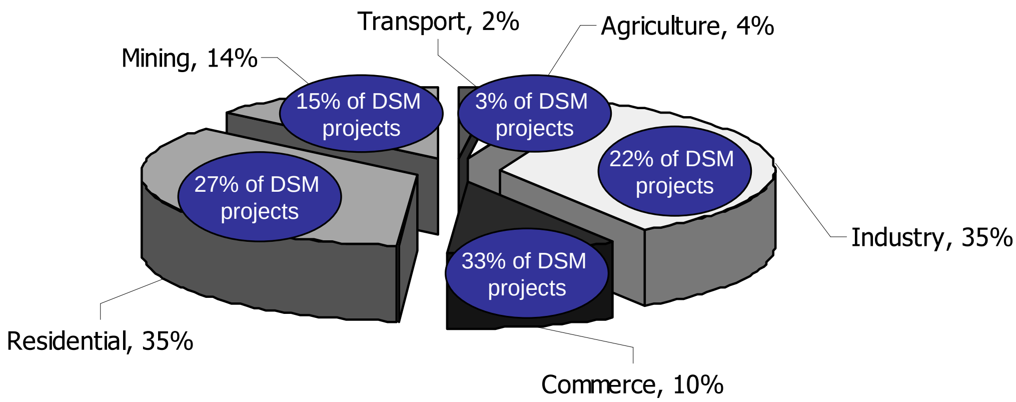

Figure 2.1: Breakdown of DSM projects in relation to sector size in terms of maximum demand
Source: Eskom, 2006

Figure 2.2 shows the major uses of residential electricity; of which uncontrolled water heating, space heating, incandescent lighting, cool storage and stove & oven shows most potential for DSM projects.

[3] In South Africa, the term industrial market refers to industries within basic metals, metals manufacturing, non-metallic minerals, food & beverage, textile pulp & paper.
The term commercial market refers to trade & finance, hospitality & tourism, Community & training, health & social care, construction & development sector. (Eskom, 2006)

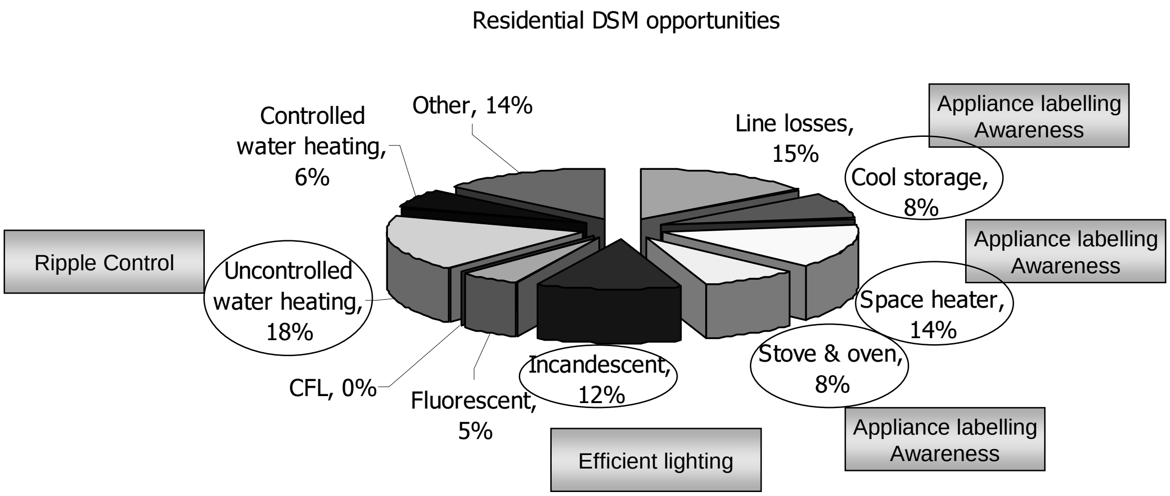

Figure 2.2: DSM interventions aimed at high consumption areas in the residential sector
Source: Eskom, 2006

Eskom state that the majority of the savings from the residential and household markets will be achieved through appliance labelling, awareness programs, efficient lighting and ripple control. The absence of SWHs from Figure 2.2 will be discussed later in the paper.

When one considers the different services on offer from ESCOs (Table 2.1) it is evident that there are some gaps.

Table 2.1: Typical services offered by Eskom-listed ESCOs

	Energy efficiency	**Load management**	**Other services**
Domestic (Single household)	• Ceiling insulation • Lighting • Air Conditioning • Geyser blankets	• Load Control Equipment	• Meter reading • Data collection • Project Management • Meter auditing • Electrical Installations • Manufactures and suppliers of electronic ballasts
Residential (Multiple household)	• Lighting	• Hot Water Load Control	• Electrical Installations • Engineering Consultancy Services
Commercial	• Soft starters	• Remote load management systems	• Facility Management • Project Management • Metering systems • Energy Demand monitoring • Suppliers of meters • Facilities Management • Ozone generating equipment
Industrial	• Lighting • Heating • Ventilation • Air conditioning • Supply and installation of variable speed drives • Co-generation • Occupancy Sensor • Soft starters • Furnaces	• Remote load management systems	• Facility Management • Project Management • Tariff Analysis • Metering systems • Energy Demand monitoring • Suppliers of meters

Source: Compiled from Eskom DSM data

The most noticeable omission from the Table 2.1 seems to be the absence of financing and CDM-expertise. The absence of financing capabilities is in direct contrast to the view in the energy efficiency strategy for South Africa that ESCOs should deliver value through a bundle of services that could include an “energy audit service, financing mechanism, equipment procurement, and installation and commissioning, operation monitoring and performance guarantees” (Department of Minerals and Energy, 2005). In the view of Nyasheng (2006), ESCOs were never seen as vehicles to deliver CDM-related services, but rather to reduce emissions indirectly by reducing the consumption of energy of their clients.

Solar water heaters (SWHs) have not been covered by the DSM fund to date, although informal commitments have been given by Eskom to fund SWHs in the future. SWH services are therefore not included in the list above.

Most of the ESCOs that would typically be involved in low income housing projects are currently involved in fairly cheap (quick-win) interventions that require little technical skill, such as the installation of energy efficient lighting and geyser blankets. If small ESCOs only operate in low tech projects, the barriers to entry will remain low and they would find themselves in an unsustainable environment. In order to gain marketable skills, training within ESCOs need to focus on the competencies required for more technical projects. Specifically with regard to the clean development mechanism, there is very little capacity among ESCOs to act as participant (i.e. project developer, project manager, monitors, verifiers, etc), even in a programmatic CDM environment. Most ESCOs focus on efficiency or load management projects, and have not expanded their skills base into other value adding services.

There also seems to be some danger of opportunism in the energy efficiency sector. It was reported recently that some ESCOs which registered during the recent energy crisis in Cape Town did not know what a “watt” was. Reports of theft as a result of access to residences were also reported. There seems therefore to be a need for more careful screening of ESCOs in the residential and domestic markets.

2.2.1 Empowerment

The DSM program has as one of its goals the empowerment of previously disadvantaged groups. The DSM evaluation criteria therefore include the extent of empowerment, as well as the skills development and training aimed at such individuals.

Although Table 2.1 on the previous page indicates the type of services on offer from ESCOs, it does not give an indication of the physical capacity within the ESCOs, nor their contribution to empowerment in South Africa. The table below indicates the empowerment status of ESCOs according to the type of sector they operate in.

Table 2.2: Availability of services by empowerment category

ESCO empowerment status	Domestic	Residential	Industrial or Commercial	**Total ESCOs**
Large Black Supplier (LBO)	0	0	2	**2**
Black Economic Empowered (BEE)	1	6	4	**11**
Black Women Owned (BWO)	2	4	7	**13**
Small Medium or Micro Enterprise (SMME)	8	0	24	**32**
None	13	2	67	**82**
Total	**24**	**12**	**104**	**140**

Source: Numbers calculated from Eskom DSM list of ESCOs

As is the case in the UK, by far the biggest majority (104 out of 140) of ESCOs in South Africa operate in the industrial and commercial sectors because the projects are bigger and therefore potentially more profitable. Only 26 of 140 ESCOs listed by Eskom can be considered as Black empowered. BEE and BWO enterprises are also considered SMMEs and are therefore favoured as suppliers due to the local economic development it implies.

What is significant is that the market seems fairly segmented. Proportionally more ESCOs with BEE or BWO status focus on the residential market (See Figure 2.4, the graphic equivalent of table 2.2). Large businesses prefer to operate in bigger markets, although the “none” group seem to target the domestic sector to a minor extent. Put differently, the ESCOs in the industrial sector are proportionately contributing less to empowerment and SMME development than those operating in the domestic and residential sectors (67 out of 104 of the ESCOs in the industrial sector do not contribute to empowerment targets, while 21 out of 36 do drive empowerment in the domestic and residential sectors).

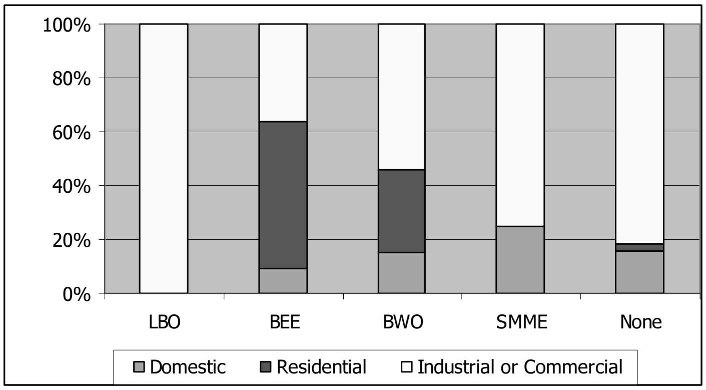

Figure 2.4: ESCO preference in terms of markets

The above statement is extremely important for the case of low income housing projects as the figures seems to indicate that the most valuable empowerment projects are happening in the small scale (domestic or residential) markets. Using ESCOs as a mechanism to deliver services in low income housing communities (i.e. residential) therefore has significant local economic development (LED) potential. Large centrally controlled businesses often do not contribute to empowerment in smaller communities, while small businesses employ people in its immediate region which is often the area in which the project is implemented.

2.2.3 Geographic availability of services

A limitation of the existing ESCOs is the absence of domestic/residential expertise in provinces outside Gauteng. As Figure 2.3 indicates, the vast majority (62%) of ESCOs operate in Gauteng. Only three of the 36 domestic/residential ESCOs indicated a footprint in more than one province. It is therefore not surprising that 87% of DSM projects completed by mid-2006 were in and around the Gauteng province (Eskom, 2006).

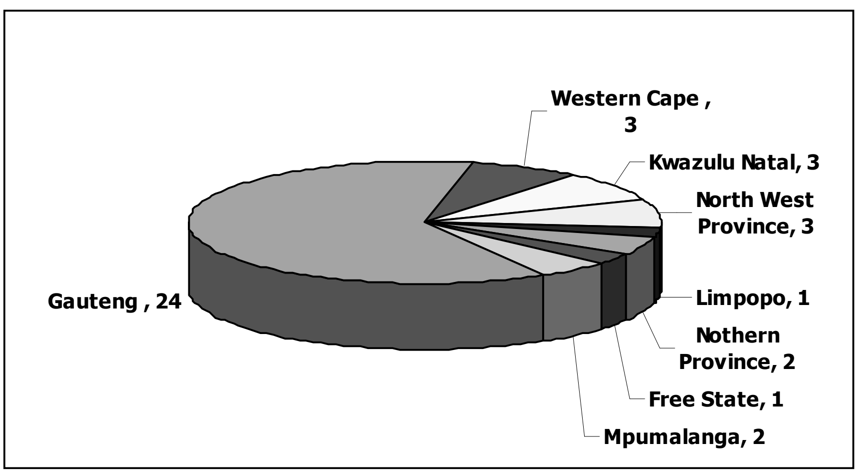

Figure 2.3: Geographic distribution of ESCOs in South Africa

The absence of ESCOs in certain provinces poses only a minor obstacle because the listed domestic / residential ESCOs do not operate in highly technical environments anyway. Given the low technical expertise expected of ESCOs in the low income housing market, it is fair to expect that the supply would match the demand if needed.

3. ESCOs and low income housing

3.1 Introduction

Low income communities can seldom afford major investments in their houses, and have not been seen to prioritise sustainable energy interventions when they do invest. What makes the ESCO model very attractive in the case of low income housing energy efficiency projects, is the fact that it offers an alternative to the notion that households must pay upfront for technologies that are more expensive than the non-efficient options.

3.2 Barriers

However, there are a number of barriers to the use of the ESCO model in low income communities. These barriers can be regarded as consumer, economic or system related.

3.2.1 Consumer related barriers

3.2.1.1 Willingness to pay

Low income households cannot afford the interventions proposed in this report without additional external sources of financing. It is a well established that poor communities use higher discount rates when valuing investments (Spalding-Fecher, Mqadi, & Oganne, 2003). The University of Cape Town Environmental Evaluation Unit (2000: 44) states that more than half of households in South Africa earn less than R600 per month. Expenditure on education and health often rate more important than housing improvements. Even though poor households may have the financial means to pay for limited energy efficient interventions, it is seldom worth their given the long payback period. This is often perceived in financial institutions as “an unwillingness to pay”.

This phenomenon is exacerbated by the absence of a visible saving for households. Few, if any, RDP houses are fitted with ceilings, geysers or other fittings. Installing energy efficient fittings implies a cost to the household and even though the spending on other energy sources may decrease, poor families do not see enough benefit to be enthusiastic about energy efficiency.

However, poor households are often willing to cover the full cost of certain interventions such as ceilings (Cousins & Mahote, 2003: 81), while they may find the investment in more expensive technologies (with longer payback period or less impact on comfort levels) less attractive.

Neither *guaranteed savings*, nor *shared savings* are options in the low income housing sector. In the case of *guaranteed savings*, customers often do not have access to financing to fund the interventions. Because the intervention brings about a virtual saving (suppressed demand) and not a monetary one, the shared *savings model* cannot work either. *Chauffage* (i.e. selling the service and not equipment) therefore remains the only option for ESCOs operating in the low income housing environment.

3.2.1.2 Trust and education regarding ESCOs

Despite the model of ESCOs not being a new idea, the model has not been fully explored in South Africa and there is a lack of experience within the industry. “As a result a confidence gap exists in the market where customers are sceptical and reluctant to use this service delivery mode. This is exacerbated by an absence of a well-established performance standard and service provider certification and accreditation.” (Department of Minerals and Energy, 2005)

Consumers show little recognition of the concept of energy services and there are difficult issues with consumer trust, largely because the motivation for the approach is not understood (Hinnells & Rezessy, 2006: 6)

3.2.1.3 Ownership of property

ESCOs would need to make provision for cases of changes in ownership of the houses where energy interventions have been installed. New owners should be aware that they are taking over a legal commitment in the form of payments for energy efficiency interventions.

One form of insurance could be the use of a deposit that would securitise the payments by the household. By using unskilled labour available in households to install ceilings and other low technology interventions (see 3.3.3.3), the "payment" to these households can easily serve as partial collateral for the outstanding fees on a house (Wesselink, 2006).

3.2.2 Economic barriers

3.2.2.1 Economies of scale

One of the biggest barriers to ESCOs in general is the economies of scale needed to make the model work. In the UK a market of four to five million customers is seen as the smallest number that can deliver satisfactory turnover (Hinnells & Rezessy, 2006). Although South Africa has a different socio economic profile it is unrealistic that a project involving a small number of beneficiaries in a low income housing community can, without other subsidies, deliver a financial return needed to keep a business operational.

Poor households have little capacity for big interventions, meaning that each household would typically only be able to contribute R30 every month (SouthSouthNorth, 2006). Assuming that there are 100 000 houses, it would suggest a turnover of R3 000 000 per month. This R3 000 000 must be used to

- repay loans on the capital expenditure invested in each of the 100 000 houses,
- repay business loans to finance capital investment in the ESCO itself,
- pay the wages of credit collectors and key staff,
- pay the wages of maintenance staff, and
- cover other administrative fixed and variable costs.

Hinnells and Rezessy (2006) state that the transaction cost per household can often be high, while the cost saving component will have to be shared between the consumer, the ESCO's profit, shareholders and the bank. If numbers are not high, the cost of bill collection and other administrative costs can take a disproportionate share of the value of savings.

A large utility could easily overcome the volume barrier, given its access to a large number of households. However, in contrast, many ESCOs are small startup businesses and will not be able overcome the initial phase of building a client base.

3.2.2.2 Retrofit vs greenfield projects

Energy efficient technologies are often more expensive than less efficient equipment, despite lower life cycle costs. This implies that being more energy efficient often implies higher expenses in the short term, but is often offset by savings elsewhere. The large initial expenditure can be greatly reduced by incorporating interventions into greenfields projects. In such a case is the additional expenditure is marginal and could even lead to cost savings.

3.2.2.3 Low electricity price

Energy price rises offer an opportunity, - the commercial sector will be more inclined to take interest while domestic consumers concerned about energy prices are often more interested in price freeze tariffs in times when prices tend upwards.

ESCOs might naturally develop an advantage if and when energy prices rise, with higher demand in relation to supply, or through mechanisms that put a price on carbon. It is important to remember that competition in electricity and gas supply began in the UK with a small number of large players and thresholds were gradually lowered to include all customers including households. The development of the energy services market in South Africa could follow a similar pattern.

One issue that has not been discussed so far in this paper is the potential loss of income that domestic/residential efficiency may have for municipalities. Typically, forty percent of electricity produced by Eskom is sold to residential consumers via hundreds of small local authorities which set their own tariffs. Often this revenue is a major income generator for municipalities. (Global Environmental Facility, 1998: 8). However, there are two reasons why this argument does not hold much water in the low income housing sector.

Firstly, low income households often do not have geysers and the provision of a SWH with electric backup may even increase the income of the municipality. When households are provided with services, they can be charged a small fee that could represent income to the municipality. This may happen in conjunction with a concession to an ESCO. If the project can be classified as RE or EE projects, it might also qualify for DSM and CDM income streams, thus reducing the upfront cost of implementation.

Secondly, there is a costly commitment from municipalities to deliver certain services to low income areas. Low income households can often not pay full fees for basic services and must be subsidised from other income streams. By implementing EE projects, municipalities may provide the same service at a lower cost. Furthermore, the Basic Electricity Grant (BEG) makes provision for municipalities to provide a defined amount of energy to all households for free. When implementing RE projects, municipalities can potentially provide certain services at little or no cost to themselves and utilise the funds for other purposes.

3.2.3 System related barriers

3.2.3.1 Lack of housing related EE legislation

Currently there are no requirements on developers to build more energy efficient houses. Typically RDP contracts are awarded to the lowest bidder. If there was some requirement for efficiency, or if an efficient house would be judged more favourably, there would be substantial opportunities for ESCOs to collaborate with contractors.

3.2.3.2 Project registration with Eskom

The fact that efficiency projects must be registered with and approved by Eskom means that the utility has the power to control the market to some extent by giving preference to load shifting above EE projects[4]. However, hopefully some of the potential areas of conflict of interest could be less pressing when the Energy Efficiency Agency (EEA) assumes control of some of the DSM fund project approval responsibilities.

3.3 Overcoming barriers to low income sustainable energy projects

Despite the barriers to using ESCOs in low income communities, there are a number of interventions that could add to the viability of the concept. These all relate to the risk-return profile of low income housing RE and EE interventions. Any intervention that may increase return or reduce risk contributes towards the sustainability of the model.

3.3.1 Public Private Partnerships

The South African government is supportive of public private partnerships at present and a combination of public and private financing, potentially through a project financing approach may allow investors with a specific risk appetite to invest in low income housing energy efficiency projects. However, these projects would typically require considerable risk structuring.

3.3.2 Clustering of households & projects

Economies of scale is one of the most important factors to make small scale energy efficiency projects work. By clustering households into communities, and eventually into countrywide projects it will be possible to leverage from economies of scale.

Furthermore, such an approach will be suitable in a programmatic CDM methodology. Project developers may work at community level, but must be able to acquire carbon financing as part of a national program.

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[4] Load management (or load shifting) is usually in response to volatile total demand in electricity and is often funded by electric utility companies as part of a DSM program. This is because load management reduces peak demand without affecting the total demand (i.e. income) negatively. Utility companies sometimes fund energy efficiency and renewable energy (or fuel switching) interventions as well, but because it is often associated with a decrease in demand, it is only done in special circumstances such as critical shortages in supply.

As mentioned earlier, an entity such as the proposed Sustainable Housing Facility (SHF) can act as national body to coordinate not only carbon financing, but also negotiate on behalf of ESCOs for other sources of income. ESCOs would use SHF

3.3.3 Combining different income streams.

The ultimate objective of an ESCO is to make a profit, and these companies usually do so through their client's payment for the energy saved through the ESCO contract. In this model the assumptions about household contributions are that poor households can contribute an amount of R30 per month or a deposit of R1000 at the beginning of the project, far less than the actual costs of the interventions. Therefore, the ESCO model would require more financing to make it sustainable. It is therefore necessary to also look at a wide range of "external" sources of income.

3.3.3.1 Chauffage and other forms of financing

Given that households can contribute very little in terms of capital, and the fact that there is technically only a virtual saving for households, the only traditional ESCO model that can be considered is *Chauffage*. However, more traditional forms of financing (rent and rent to own) can also offer feasible solutions.

(i) Chauffage

In a *Chauffage* or sale-of-energy transaction (as opposed to purchasing electricity), consumers often pay between 75 and 90% of the reigning cost of heating an equivalent amount of water, an implied saving of 10 – 25 percent (Guiney, Harrison, Kaufman and Milton, 2006: 12). Because RDP houses are generally not fitted with geysers, the fee that is charged to the household is an additional cost every month and might not be viewed as a saving. However, under the assumptions of the suppressed demand methodology, there is indeed a future saving if one assumes that the household may install a normal geyser in the future.

The fee charged by the ESCO can be adjusted periodically or stay constant over the life of the contract. Fixing the price could be an attractive option in order to enroll a large number of customers at the start of the project.

Another option could also be delayed payment. By delaying the first payment of the household, it might be possible that households with increased income might be able to afford payments it could not have made before.

The fee-for-service model relies on the accurate measurement of energy savings. Eskom has contracts with seven universities to undertake the monitoring and verification (M&V) of the ESCOs applications to the Fund. These universities have developed sophisticated M&V models to deal with this, and have the capacity to deal with suppressed demand baselines, although these are unprecedented in the DSM fund and may need to be dealt with through modifying the baselines on a fairly continuous basis. Some relaxation of the currently used measurement techniques and accuracy may be required in order to reduce transaction costs and to reflect the additional social and environmental benefits of the interventions. Alternatively, a fixed upfront cost may be a more appropriate financial model.

(ii) Rent to own

In rent to own programs, the amount charged to the client is determined by the value of the asset and not the level of use. Guiney, Harrison, Kaufman and Milton (2006: 14) states that the lease could potentially expire before the asset is paid for, which implies that the SWH or other equipment will then have to be removed. This is not advisable as a second hand market for energy efficiency equipment is non existent.

(iii) Rental

A rental program will be very similar to a rent to own program, but in such a scenario the equipment will never be the property of the household. This could be a very attractive option for ESCOs as the contract would substantially increase in profitability when the asset is fully repaid. If the intervention is paid in full after a number of years, the additional income can finance further projects. However, this could potentially lead to exploitation of poor households if unregulated.

3.3.3.1 External Sources of Financing

There are a number of sources of financing that exists outside of the agreement between an ESCO and its client. Such forms of income could effectively be used to reduce the amount that households should contribute, or shorten the time it will take the household to own the asset. These alternative sources of income could include:

- Certified Emission Reductions (CERs)
- Tradable Renewable Energy Certificates (TRECs)
- Demand Side Management and other subsidies
- The basic energy grant
- Promotional bundling with consumer companies
- Investments from companies leading to tax credits or seen as CSR investments
- Skills development levy

There is an argument to be made for ESCOs to drive access to these funds rather than government, municipalities or non-government organisations. Using ESCOs is economically a more efficient mechanism as it would be in the ESCO's interest to fulfill the function well.

(i) Certified Emission Reductions (CERs)
As mentioned earlier, ESCOs generally do not have the capacity to initiate and complete CDM projects without assistance. The cost involved to develop, register and monitor individual CDM projects is too high for most ESCOs to absorb.

It is unlikely that the required economies of scale can be achieved with one project or within only one community. As is shown elsewhere in this report, the NPV of carbon financing is highly influenced by economies of scale. Housing the CDM methodology in a separate entity like the proposed Sustainable Housing Facility or SHF would be able to overcome this barrier of scale. ESCOs would interact with the SHF to register their CERs on a smaller but cheaper scale.

Monitoring and Verification would still need to occur through a separate entity, a Designated Operational Entity (DOE) under the CDM requirements. One local DOE exists currently (PriceWaterhouseCoopers) which could potentially perform this task.

(ii) Tradable Renewable Energy Certificates (TRECs)
ESCOs could operationalise a TREC scheme by monitoring (through SWH sales) and verifying TRECs. However, a central entity would still be required to collate and sell the credits. The SHF can also fulfill this function. It is important to note that ESCOs would not be able to claim income from both CERs and TRECs.

(iii) Demand Side Management and other subsidies
ESCOs are well placed to act as implementing agents of the DSM subsidy for low income housing projects, and could potentially also play this role for other types of subsidies. However, the need for a central coordinating body such as the SHF would be required.

(iv) The Basic Electricity Grant
Should the application of the BEG for low income sustainable energy projects be successfully negotiated, ESCOs could have role to play in the grant spending and monitoring.

(v) Promotional bundling with consumer product companies
Mobile communication companies in South Africa often use bundling of products as a promotional tool. An unexplored option for the sale of SWHs could be the bundling of SWHs with contracts with mobile phone companies or similar types of contracts. Products available to mobile users often range from between R50 – R3 500 in value (depending on the nature of the contract and phone included in the contract). Combined with the DSM subsidy and CDM funding, it may be possible to fund the total cost of certain interventions. What makes this option all the more attractive is the geographic infrastructure of the big mobile phone companies.

Pay-as-you-go packages are very common among low income households. Another attractive characteristic for the mobile phone companies is therefore that they would increase the number of contracts in poor communities by bundling contracts with energy efficient equipment. At best this would be an option given to households, but would it would be difficult to enforce this on a whole community.

ESCOs would generally be too small to negotiate this type of contract with mobile companies (or similar contracts with other companies). On the other hand, the SHF would have the size and clout to negotiate on the behalf of ESCOs. However, once agreed ESCOs would act as intermediary in the implementation of such a program.

(vi) Tax Credits

Low Income Housing Tax Credits are the main source of public funding for low income rental housing developments in the United States of America (Hettinger, 2005: 13). This is but one example of how tax legislation may make a contribution to projects that would normally require government funding. By allowing tax-deductible investments in certain types of projects, companies gain a tax shield.

Theoretically, low income housing energy efficiency projects could qualify for such investments. However there is currently no such legislation in South Africa and it is solely mentioned in this report as an example of government incentives to the private sector.

In this type of scheme, the ESCO will be contracted by the company making the investment or by a developer acting on behalf of the investor. ESCOs, as mentioned before would not have the power to lobby at the level of government, while the SHF would be much better equipped to do so.

(vii) Skills Development Levy

In cases where sustainable energy projects include skills training, funding from the national skills development program can be accessed. ESCOs can act as training facilitators in basic skills such as masonry or plumbing skills, and these trained artisans can be used during the project. Financing could even be accessed through the training of households to fit their own ceilings. For this to happen, unit standards would need to be in place with the South African Qualifications Authority (SAQA). The development of such standards is clearly outside the competencies of most ESCOs. Such standards could be developed by educational institutions, but should ideally be coordinated by an organisation such as the SHF.

3.3.3.3 The role of ESCOs in mobilising revenue sources

As shown above, there are numerous sources of financing that may contribute to the income generated by ESCOs.

Figure 3.1 shows potential income streams into the ESCO model. In this model the ESCO operates as a close corporation or company.

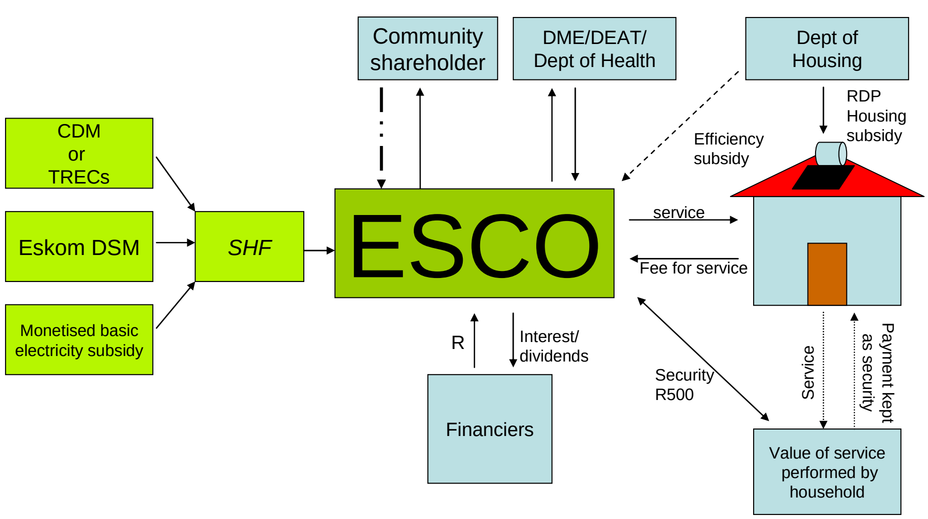

Figure 3.1: Incorporating different sources of income

The diagram illustrates the interaction of ESCOs with different entities or financiers.

- The project developer is not shown as it is technically not a source of income. However, the developer would typically allocate a concession to the ESCO for a specific period, giving the ESCO the right to operate and the right to all sustainable energy related sources of income.
- Various subsidies (Department of Housing, Department of Environmental Affairs and Tourism, Department of Minerals and Energy, Department of Health) may be part of the model. These subsidies could enter the process either through the SHF, the ESCO, the Housing Developer or the individual homeowners.
- The Sustainable Housing Facility would play a coordinating role to facilitate access for ESCOs to DSM, CDM and numerous other sources of income.
- Typically banks or venture capitalists would be financing all or part of the capital of the ESCO.
- It may be wise to allocate shareholding in the ESCO to the community in order to encourage buy-in. Profits to the community can in turn be used to recover defaulting contracts, or to upgrade the community.

In order to act as security against default, ESCOs may be able to make use of labour from each household and in return keep the payment as security, or use it to finance the community's shareholding. Typically the ESCO would be contracted to install the ceilings and other equipment, but the less technical work can be subcontracted to the household. Wesselink (2006) suggests making use of households to install low technology equipment.

By training a group of households to, for example, to fit a ceiling, a saving is made in terms of the total project cost. The amount budgeted for this deliverable amounts to approximately R1000 per house. It could be an additional requirement that the initial group of households should train another group in a "each one teach one model". Once successfully completed, the household will be given a proof of deposit for R1000 into a central account. In this way, the community will not only contribute to the project, but will gain valuable skills and acquire a sense of pride in their community. The ESCO would in such a case play a coordinating and quality control role.

4. Conclusion and recommendations

Energy service companies remove the obstacle of high initial investment in some energy efficiency projects. Furthermore, by acting as the central role players, ESCOs facilitate the flow of funds from investors to end-users in an economically efficient way.

By making ESCOs responsible for the mobilisation of various sources of income (with the co-ordination of the SHF) it would minimise the transaction costs and potentially be much more efficient than placing such a function with government, non-profit institutions or in another private sector entity. This is mainly because it is in the interest of the ESCO as a private sector risk based entity to fulfil the function effectively and at the lowest cost.

It have been shown that the typical ESCO operating in the residential market is more likely to boast BEE credentials than those operating in other markets. ESCOs operating at this level are also often SMMEs, meaning that the profit they earn would often go to the empowerment of entrepreneurs, rather than to the pockets of a rich few.

In addition, the promotion of low income housing ESCOs would do much to empower previously disadvantaged communities. These projects typically require services at community level, implying skills development, employment and other forms of local economic development. Centrally controlled energy generation has historically not contributed much to employment in rural areas or among low income communities. The sustainable energy project suggested in this report would do much to employ people who otherwise would not have had access to semi-skilled jobs as would be required for the interventions discussed here. This issue is of great importance seen in the context of the increasing problems surrounding urbanisation.

ESCOs would not only require semi-skilled workers during the installation phase, but would also require workers to do maintenance, collect service fees and do measurement and verification work. The sustainable employment of people in jobs that give them status will create much pride and ownership in a community.

This report illustrated ESCOs as a efficient and effective mechanism for bridging the gap between sustainable energy solutions and communities that would not normally have access to energy services. Doing so has added benefits relating to local economic development.

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APPENDIX A: ESCOs operating in the Domestic or Residential markets

Company Name	Province	Empowerment	Area of Expertise	Technology
AAAMSA	Gauteng	None	Domestic	**OTHER** * Ceiling Insulation **LOAD MANAGEMENT** * Hot Water Load Control **OTHER** * Independent Power Producer
DSP Electrical Contractor and Installations	Gauteng	BEE	Commercial, Industrial, Residential	**ENERGY EFFICIENCY** Lighting **OTHER** Electrical Installations
Energy Resources Optimizers	Gauteng, Western cape	BEE	Commercial, Industrial, Residential	**ENERGY EFFICIENCY** Lighting **LOAD MANAGEMENT** YES **OTHER** Engineering Consultancy Service
Energy Wise Industries	Gauteng	None	Domestic Commercial	**OTHER** * Suppliers of energy devices for lighting
Eskom (Energy Efficient Services)	Gauteng	None	Redistributor Commercial Industrial Domestic	**ENERGY EFFICIENCY** * Lighting * Air Conditioning **LOAD MANAGEMENT** * Hot Water Load Control
Eternity Star	Northern Province	SMME	Domestic	**ENERGY EFFICIENCY** * Lamps
F&S Enterprise	Gauteng	BWO	Domestic	**ENERGY EFFICIENCY** * Lighting
Geezerduvet CC	Western Cape, KZN and Gauteng	None	Domestic	**ENERGY EFFICIENCY** * Geyser blankets
IST Otokon	Gauteng	BEE	Residential	**ENERGY EFFICIENCY** * Variable speed drives **LOAD MANAGEMENT** * Hot water load control * Scheduling of Industrial equipment
Khawuleza Technologies	Free State	SMME	Redistributor Domestic	**OTHER** * Meter reading * Data collection
Lebone Engineering	Gauteng	SMME	Domestic Commercial	**OTHER** * Energy consultants
Lesego Limpho Logistics	Gauteng	SMME	Domestic Commercial Industrial	**ENERGY EFFICIENCY** * Lighting
Lohuis SA	Gauteng	BEE	Domestic Commercial Industrial	**ENERGY EFFICIENCY** * Supplier of light bulbs and fluorescent tubes
MAEMSA	Gauteng	None	Domestic	**ENERGY EFFICIENCY** * Lighting

Modikeng Electrical	Mpumalanga	SMME	Redistributor Domestic Commercial	**OTHER** * Electirical installations
Molemale Bussiness Enterprise	North West Province	BEE	Commercial, Industrial, Residential	**ENERGY EFFICIENCY** Lighting **LOAD MANAGEMENT** YES **OTHER** Engineering Consultancy Service
Motla Engineering	North Western	None	Redistributor Residential Commercial Industrial	**ENERGY EFFICIENCY** * Lighting **LOAD MANAGEMENT** * Hot water load control
Nationwide Electrical	KZN	BWO	Commercial Residential	**ENERGY EFFICIENCY** * Lighting **LOAD MANAGEMENT** * Hot water load control
Neppa	Gauteng	SMME	Domestic Commercial	**ENERGY EFFICIENCY** * Lighting
Noratec	Gauteng	BWO	Commercial Residential	**ENERGY EFFICIENCY** *Lighting **LOAD MANAGEMENT** *Hot water load control
Osram	Gauteng	None	Domestic Commercial Industrial	**ENERGY EFFICIENCY** * Supplier of lamps
Peer Africa	Gauteng	None	Domestic Redistributors	**OTHER** * Project Management
Philips South Africa	Gauteng	None	Domestic Commercial Industrial	**ENERGY EFFICIENCY** * Suppliers of lamps
Ponego Electrical Services	Gauteng	BWO	Redistributor Domestic Commercial	**OTHER** * Meter auditing
Rangaphanda	Gauteng	BWO	Commercial Residential	**ENERGY EFFICIENCY** *Lighting
Sinotho Electrical & Civil	KZN	SMME	Domestic Commercial	**OTHER** * Electrical Installations
Sustainable Energy South Africa	Western Cape	BWO	Commercial, Industrial, Residential	**ENERGY EFFICIENCY** Lighting **LOAD MANAGEMENT** YES **OTHER** Engineering Consultancy Service
TSA- Khomotso Electrical	Limpopo	None	Domestic Commercial	**ENERGY EFFICIENCY** * Lighting
Tridonic	Gauteng	None	Domestic Commercial Industrial	**ENERGY EFFICIENCY** * Manufactures and suppliers of electronic ballasts
Tsekema Consulting	Gauteng,	BEE	Commercial,	**ENERGY EFFICIENCY** Lighting

Engineers	Mpumalanga, North West, Northern Province		Industrial, Residential.	**LOAD MANAGEMENT** YES **OTHER** Engineering Consultancy Service
Tshepo Thato Consulting	Gauteng	None	Domestic	**ENERGY EFFICIENCY** * Lighting
Usizo Engineering	Gauteng	SMME	Domestic Commercial Industrial	**OTHER** * Consulting Engineers
Vikinduku Engineering and Projects	Gauteng	BEE	Commercial, Industrial, Residential	**ENERGY EFFICIENCY** Lighting **LOAD MANAGEMENT** YES **OTHER** Engineering Consultancy Service
Vortex Industrial Products	Gauteng	None	Domestic	**ENERGY EFFICIENCY** * Supplier of energy saving lamps
World Focus	Western Cape	None	Domestic	**LOAD MANAGEMENT** * Load Control Equipment