Barriers inhibiting investment in DSM in South Africa

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1. Introduction

The term 'demand-side management' (DSM) was first used in the United States in the early 1980s to describe the 'planning and implementation of utility activities designed to influence the time, pattern and/or amount of electricity demand in ways that would increase customer satisfaction, and co-incidentally produce desired changes in the utility's load-shape' (Gellings 1989). DSM – as an alternative to system expansion as well as a tangible means of providing customers with a valuable service – was later adopted in the United Kingdom, Europe, and Australia. Today, DSM-associated initiatives are practised worldwide, although not necessarily referred to as DSM programmes.

In South Africa, DSM is still a relatively new concept to most. While Eskom formally recognised DSM in 1992 when integrated electricity planning (IEP) was first introduced, the first DSM plan was only produced in 1994. In this plan, the role of DSM was established and a wide range of DSM opportunities and alternatives available to Eskom were identified (Ellman & Alberts 1999). Some municipalities and local service providers currently undertake activities seeking to 'produce desired changes in the utility's load shape'. Some of these activities can be classified as DSM initiatives, other not. The reason for this, generally, is that this latter group of activities tends to focus on achieving load impacts, and is not necessarily geared towards bringing about increased customer satisfaction (see section 4 in particular). In the White Paper on Energy Policy, the South African government recognises the importance and potential of energy efficiency, and commits itself to promoting the efficient use of energy in all demand sectors. It also commits itself to investigating the establishment of 'appropriate institutional infrastructure and capacity for the implementation of energy efficiency strategies'. Currently, it seems as though the Department of Minerals and Energy is beginning to move in this direction.

In this report, the principal barriers inhibiting investment in DSM and/or energy efficiency are outlined. *The report focuses on the barriers faced by Eskom and municipalities.* This focus has been chosen in line with the nature and purpose of the project for which this report is written: barriers affected, and brought about, by electricity industry restructuring are most relevant. Aspects of DSM and electricity demand that do not relate directly to electricity industry restructuring would bring unnecessary complexities to this discussion. While the report focuses on the barriers faced by Eskom and municipalities, commentary on government and customer barriers is also given. The role of customers is clearly pivotal: either customers will choose to invest in DSM or they will not. Thus, in designing DSM programmes, Eskom and municipalities should not only address barriers directly impacting on themselves, but also those affecting their customers. Because 'the economic, political, regulatory and competitive environment under which a utility operates will dictate the level of activity and approach to DSM' (Surtees 1998), it is also important to take barriers faced by government into account. Finally, it should be cautioned that many of the barriers presented here would not in themselves inhibit investment in DSM. It is generally, but not always, an entire basket of barriers that ultimately halts this investment from occurring.

This report is divided into six remaining sections. Section 2 gives an overview of the different types of DSM: as should become clear in this report, it is important to differentiate between energy-efficiency-type DSM and other load management options. In the third section, residential, commercial and industrial customer barriers are described. Sections 4 and 5 outline current initiatives of, and barriers faced by, municipalities and Eskom respectively. Government's position on energy efficiency, its current programmes and obstacles it faces in this regard are presented in section 6. A conclusion and appendices – including a list of the people who were interviewed for this research, as well as specific case studies of municipal and Eskom DSM investment – follow.

This report represents the second in a series of five research outputs for an Eskom-sponsored project entitled *Implications of electricity industry restructuring on investment in DSM*. Other outputs of this research include: (a) an international review of what has happened to DSM as other countries have sought to restructure their electricity industries; (b) an outline of the prospects for investment in DSM in different ESI restructuring contexts; (c) recommendations to the National Electricity Regulator (NER), Eskom and government on how to ensure the survival

and growth of economically viable DSM; and (d) recommendations on funding options for DSM in the new ESI context. This report – on the barriers inhibiting investment in DSM in South Africa – is important to this project because it provides guidance to the researcher, and policymaker, on what the most important stumbling blocks in this area currently are, and thus guidance on how to design policy and programmes so as to 'do better' in the future. In a forthcoming report – the outline of the prospects for investment in DSM in different ESI restructuring contexts – effort will be lent towards questioning whether ESI restructuring will remove or reinforce the barriers identified in this report, or in fact whether restructuring introduces new barriers which will have to be taken into account.

2. DSM defined

Demand-side management interventions came generally be broken down into four broad sub-categories. These are (i) strategic load growth; (ii) load shifting; (iii) interruptibility; and (iv) energy efficiency interventions. These are illustrated in Figure I below.

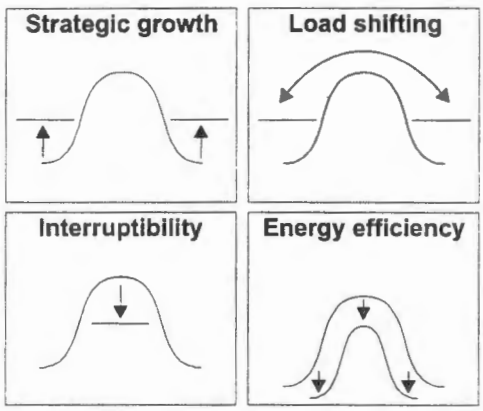

Figure 1: DSM options
Source: Eskom (1997)

- *Strategic load growth* involves the creation of additional electricity sales with due regard to the time of day and point on the network at which the electricity is consumed. Strategic load growth initiatives are adopted by utilities under conditions of surplus generating capacity.
- *Load shifting* involves the modification of the time at which a customer uses electricity. This is achieved primarily through the provision of price-based incentives such as time-of-use (TOU) tariffs and real-time pricing (RTP). Direct utility load control is also used. For example: customers may allow a utility to control their hot water geysers in return for some (usually tariff-based) incentive. Both the utility and the customer should therefore benefit from the transaction.
- An *interruptible* load agreement allows the generator to interrupt power supplied to a portion of a customer's premises for a limited period of time in return for compensation. A curtailable load agreement is an interruptible load agreement in which the customer reduces electricity demand in response to price signals from the utility. The utility benefits from these agreements as it enables operation at lower reserve margins (in the event of plant failure, the utility disconnects these customers until contingency plans can be implemented). The customer benefits through a lower average electricity rate or specific event-related compensation.
- *Energy-efficiency* DSM primarily involves the conversion to more efficient end-use electro-technologies and the adoption of more efficient behavioural practices (often related to energy conservation) for the system as well as customer benefit. Some conflict of objectives arises when utilities have ample or excess capacity. Utility revenues are reduced (savings are in short run marginal generation costs, which can be below the electricity selling price).

Only when the avoided new construction costs are greater than potential revenue, are energy efficiency initiatives financially viable for integrated utilities.

In this report, DSM interventions of each of these four types are discussed.

3. Customer investment in DSM

To succeed, most DSM programmes require the voluntary participation of residential, commercial and industrial customers in order to succeed. If customers choose not to invest in DSM, programmes will fail, no matter what resources are allocated to it. If customers choose not to participate yet the initiative still succeeds, it must then be argued that it was never true DSM in the first place. Customers of Eskom and municipalities may not choose or be able to take up DSM for various reasons, the principal ones of which are listed below. It should be noted that the barriers listed below may not, in themselves, be influential enough to prevent DSM investment. DSM investment is thought for the most part to be inhibited by the cumulative effect of a series of barriers.

3.1 Residential customer barriers

Residential customers – in particular, low-income residential customers – are faced with various barriers that may inhibit them from investing in DSM – in particular energy efficiency. The most prevalent of these barriers are listed in this section. They are barriers related to information and awareness, affordability, access, risk, and elasticity of demand-associated issues.[1]

3.1.1 Investment is constrained by information and awareness gaps

There are various ways in which information about energy efficiency and DSM is constrained. These include:

Misinformation. Adoption of energy efficiency can be constrained by inaccurate information, for example, that energy conservation is about 'freezing in the dark' or that electricity is the best fuel for all end-uses.

Lack of information. This includes a lack of current and credible information on the latest energy-efficient technologies, on the relative performance and savings of comparable appliances, and a lack of information on current energy consumption patterns and potential markets. It is argued that customers tend to understand the principles underpinning load shifting better than those underpinning energy efficiency (see above).

Difficult access to information. While information about DSM and energy efficiency may exist, it may be poorly disseminated or not in an accessible form. Examples include lack of knowledge by consumers on the range of DSM options available to them, lack of technical knowledge with regard to specification, installation and maintenance of the specific energy-efficient technology, and lack of understanding of concepts such as life-cycle costing.

Expensive information. There may be high transaction costs associated with obtaining timely and credible information. For example, in the delivery of thermally efficient low-cost housing, design expertise is expensive to acquire in terms of both time and money.

Difficulties with using or acting on information. End-users may be unable to use the information at hand due to affordability constraints, or they may lack education and training.

3.1.2 'Participation' entails high initial, and often unaffordable, capital outlays

Energy efficiency is a relatively new concept for most households, so improvements in this regard tend to necessitate a re-evaluation of households' energy usage. Energy efficiency improvements usually entail the purchase of different or additional appliances (for instance, compact fluorescent lamps in the case of energy-efficient lighting) and/or the installation of home improvements (for instance, ceilings in the case of thermal efficiency). Many, if not most

[1] For more details on these residential end-user barriers see Simmonds & Clark (1998).

low-income households are barred from investing in such energy efficiency improvements because they cannot afford to do so. This affordability concern is perhaps the most troubling of all obstacles faced by most households in South Africa. Not only are most households unable to invest in energy efficiency improvements on their own, but by virtue of their financial standing, experience considerable difficulties in accessing additional finance. In fact, because of this same affordability barrier, poor households sometimes end up investing in fuels and appliances, which, ironically, are inefficient in terms of both energy and economics.[2]

Interestingly, Surtees (1998) shows that residential customers are generally willing to re-schedule their load through the use of timing devices or through utility control (of a geyser).[3] Because of affordability barriers, however, Eskom and/or municipalities would have to provide the time-switching devices and/or related technologies to enable customers to interact with utilities in this way.

Notwithstanding the fact that many South Africans cannot afford to invest in DSM, it should be noted that households are often dissuaded from doing so because electricity prices are low. It does not pay households to commit scarce resources to DSM investments that offer relatively long payback periods, especially when the alternative to the investment yields instant benefits.

3.1.3 Technologies and fuels are sometimes physically unavailable

In section 3.1.2 it was noted that low-income households are unable to access DSM because they are inhibited financially from doing so. There are also other kinds of access barriers. Households are often unable to access technologies that could assist them in reducing the amount of energy that they use, or give them access to preferential tariffs. Often this is because fuels and or appliances are not physically available, either at all, or in small, affordable quantities.

3.1.4 Households often perceive investment in DSM to be too 'risky'

Risk barriers that households face relate to those which discourage consumers from participating in DSM programmes or buying energy-efficient technologies. Switching to unfamiliar technologies (for example, compact fluorescent lamps, solar water heaters, ripple control) or fuels (for example, gas) poses high risks to poorer households, particularly where there are large costs associated with the switch and where households are unsure of the durability and reliability of the fuel and device and the appropriateness of the process, technology and/or fuel to meeting their needs. These households are unlikely to make the switch to more efficient appliances, fuel combinations or new energy usage patterns unless they are satisfactorily familiarised with the process, device or fuel, guaranteed support in the event of technology failure, or provided with inviting incentives to make the change.

3.1.5 Households demand for electricity is often inelastic

For energy-efficiency DSM to be effective, householders must reduce the kWh they consume. For strategic growth and load-shifting DSM interventions, peak kWhs should be reduced, while off-peak electricity usage is encouraged. Most households experience difficulties in altering the pattern of their electricity demand. In some cases, they utilise energy at peak times, which they would not utilise off-peak (i.e. electricity for lighting, and perhaps space heating). In this case, electricity demand is inelastic. In other cases (heating water, cooking and ironing), electricity demand is slightly more flexible, but not much more. In an attempt to avoid the high cost of peak electricity demand, people are unlikely, for instance, to readily agree to iron clothes or do washing at midnight. Depending on household income and other factors, household dwellers would rather do without the service (i.e. not iron clothes) or alternatively would be prepared to shoulder the additional costs associated with using electricity at times when it is convenient for

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[2] Indeed, households' cash flow crises do not allow them to respond logically to the results of a cost/benefit analysis, which takes life cycle costs and benefits into account.

[3] This, Surtees (1998) argues, is the case for all end-uses with the exception of air conditioners, refrigerators and space heaters.

them to do so. Thus, a barrier to DSM is that households' demand for electricity may not be as flexible as would be required for successful implementation.

Surtees (1998) suggests that, although some customers have expressed some willingness to change routines such as washing up times and bathing/showering, the magnitude of savings to be derived from these changes may not warrant the associated inconvenience, both to the utility and to the customer. Interestingly, customers are often averse to allowing utilities to limit heat over peak period. He suggests that this relates to many households' inability to retain heat (rapid heat loss is often experienced when heat devices are switched of).

3.2 Industrial customers

Through DSM-related initiatives, there are a host of opportunities to reduce business costs throughout a wide range of industries. In some instances these opportunities are being utilised, in others not. In this section barriers inhibiting investment in DSM in industry are described. Barriers discussed are those which emanate from discussions with Eskom and municipal staff, as well as those found in Surtees (1998).

3.2.1 Demand for power is often inelastic

DSM-related activity and investment can result in 'bottom-line losses' to industry. Interruptibility, for instance, can bring about production losses, and load-shifting can result in labour overheads increasing (because overtime costs can sometimes rise significantly). In general, industry managers are loath to allow this to happen, which is one reason why most of Eskom's industrial customers prefer to maintain load control of all plant components, and why, currently, the potential for any additional Eskom-controlled interruptible load is limited. This is certainly occurring in the mining, chemical and petroleum (except for cement) sectors, as well as in iron and steel industries. In the base metals sector there is slightly more opportunity for (external and internal) interruptibility measures – that is, where excess capacity exists, and where the threat of production loss is not significant – but notice periods are still required for any load changes (Surtees 1998).

In addition to it not being in the so-called financial interest of the various industries to shift power demand (because doing so results in production losses and increased labour overheads) some industries are unable to do this anyway. This 'unavoidably' inelastic or inflexible demand is illustrated by the mining sector where negligible potential for external party (Eskom-controlled) or internal load-management initiatives exist because power is required on a continuous basis throughout the day.[4] The same can be said of the chemicals metal processing industries which experience difficulties in altering energy usage below full capacity once a specific size technology has been invested in (Visser 1999).[5]

In instances where there is some flexibility to shift or interrupt load but where doing so threatens to have a negative impact on the 'bottom line', substantial incentives need to be offered to industry to undertake this type of DSM. These incentives (tariff adjustment on contractual basis) provide a useful mechanism for reducing this particular barrier but are clearly not always financially feasible from Eskom's point of view. Another possibility is to promote DSM through the use of more efficient technologies that do not require a reduced level of service (see below).

3.2.2 In the current economic context, DSM is hard to justify

DSM benefits begin to be realised in the short term (in terms of reduced energy costs) but generally entail medium-term payback periods (recouping the costs of installing equipment). Where domestic and global selling prices for industrial commodities vary significantly (and are often volatile), and where long-term price certainty or stability is not a given, industry managers

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4 Maybe a few mines could place reservoir pumping load on an interruptible scheme but this represents a very small fraction of total load (Surtees 1998).

5 Alusaf's production facilities are reasonably flexible, however, being able to sustain power interruption for up to two hours (Visser 1999).

are often hesitant to take on the additional risk associated with investing in DSM. Industry managers find it hard to justify replacing equipment that is still operating and has been paid for with expensive equipment modifications (energy efficiency and load management) that generally require (a) its operators to be taken out of commission to receive additional/new training in the new technology, and (b) planning processes to be reassessed. Industry managers, concerned that their DSM investments could easily become stranded, often thus choose to adopt an investment approach which is capital-averse and based on short-term industry requirements.

3.2.3 Power reliability and quantity is valued more than energy efficiency

Most of the obvious opportunities for investment in DSM have already been taken up by industry. Reliable and quality power supplies have then become the priority issues above additional (or advanced) investment in DSM.

3.2.4 Electricity is not always the primary cost

The actual nature of one industry compared with another makes responses to energy price changes and to DSM opportunities vastly different. In some industries – such as gold (10%) or ferrochrome (35%), electricity does not represent the primary variable cost . In other industries, such as aluminium, electricity may represent one of the most important input costs, or alternatively, all costs are important because the industry operates on a very tight profit margin (such as the steel industry). Where industry managers are also operating within the contexts of a changing society, a dynamic political transition, complex labour laws, and uncertain economic circumstances, DSM is frequently not viewed by the former industries as a priority and not considered seriously for investment.

Some argue that the low cost of electricity also represents a barrier to investment in DSM. Others reject this, suggesting that in the context of the current economic climate industry managers will do anything to improve profitability.

3.2.5 Appropriate technology is sometimes not readily available

'Inaccessibility' or 'unavailability' of technology required for energy efficiency and load-management DSM has been cited as a barrier inhibiting investment. It is debatable whether this is, in fact significant. To the contrary, some argue that equipment is always available as long as industries are prepared to pay for it. Additionally, it is argued that many of the large industrial processes are specialised to the extent that there is not scope for technological substitution – that is, the processes used are the only ones available.[6]

3.2.6 Utility strategies tend not to favour smaller industrial customers

In line with global best practice, Eskom houses a Key Customer Division which seeks to service Eskom's major (top four hundred) customers, as well as protect its revenue base. Customer Executives service customers on a sectoral (steel, chrome, platinum, water, transport, chemicals etc) basis as well as a geographic one (NorthWest, Western Cape, etc). These are co-ordinated by a Sector Manager. It has been noted that this key customer approach has been progressive and in line with the needs of the industry. This approach and the benefits associated with it do not extend, however, to smaller industry players (such as welders, butchers, etc). Eskom believes that most of these smaller industry players are serviced by municipalities and it goes beyond Eskom's scope to offer similar services. Unfortunately, most municipalities in South Africa are not able to extend such services. The result is that, even if smaller industry players would like DSM-related support, it is often unavailable to them.

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[6] An example of this can be found in the aluminuim industry where the Hall-Heroult process is used. This process is the only process that has been developed for the electrolytic reduction of aluminium. The technology is hightly optimised, and it is unlikely that it will be replace by any other system for 25 years (Visser 1999).

3.2.7 Some industry managers appear to be resistant to change

One of the people interviewed during this research commented that 'there are lots of managers out there, but few who make a strategic difference in this area'. Although there is clearly no scientific basis for this, it has been suggested that this is because some industry managers are resistant to change – which can partially be attributed to the perception that energy efficiency-type DSM is expensive and also means a reduced level of service. It can also be attributed to the dilemma that some industry managers face: it *is* difficult for industry managers to justify investing in new technologies and negawatts which to a large extent have unproven capabilities when supply-side solutions seem to work well enough.

3.3 Commercial DSM

Property owners in South Africa prefer, in general, to maintain control of their own facilities and are unwilling to transfer this control to utilities for load-management purposes. While not entirely obviating opportunities for implementing commercial DSM, this certainly limits the amount of load-management-type DSM that does occur. It has been shown, however, that there is a huge potential to improve the thermal and energy efficiency of commercial buildings. Some project that buildings could use 50 per cent less electricity and still offer comfort. The principal barriers inhibiting this investment from occurring are given below.

3.3.1 Small commercial enterprises cannot afford the upfront costs

Even though economic analysis shows that DSM makes economic sense, many commercial enterprises cannot afford to pay the *upfront* costs associated with DSM (especially the energy-efficient type). In some developed countries, this barrier does not apply because financing mechanisms have been put in place to assist these enterprises with paying for associated upfront costs. Most often, Energy Service Companies (ESCOs) help, through Energy Performance Contracting Agreements, to finance these costs. In South Africa only a very small number of ESCOs offer this service.

The decision to invest in DSM is further complicated by the fact that most commercial outfits are already fitted with equipment that 'seems' to serve the same purpose as more efficient equipment, *and* is already paid for.

3.3.2 Industry drivers and support are limited

In other countries where energy-efficiency-type commercial DSM (CDSM) has been implemented successfully, the process has most often been driven by the ESCO industry. In South Africa, as noted above, this industry is in its infancy and is yet to make a notable impact. Additionally, commercial DSM is often seen as 'risky business' by prospective and existing ESCOs because concepts such as 'energy performance contracting', 'shared savings mechanisms' are not well understood, or widely recognised or endorsed.

In the absence of support from a strong ESCO industry, it is natural to look towards utilities to provide this service. Currently, as shown below, Eskom does invest in some commercial DSM activity. On the whole, though, Eskom is currently not giving a clear message to electricity industry stakeholders and customers that DSM (and commercial DSM) is the way to go (see section 5 below for the barriers inhibiting investment in DSM at Eskom). Its investments in CDSM to date are illustrative of Eskom's hesitancy in this area. As noted in section 4 below, many municipalities in South Africa are often loath to initiate any project or process that could threaten their revenue base in any way. Energy-efficiency-type DSM threatens to do just this. Municipalities face overwhelming capacity constraints that inhibit growth and development in this area. Coupled to this, municipal staff are often resistant to change, as well as keen to sustain restful livelihoods. Hence the noticeable absence of municipality-led CDSM investments. Finally, while national government notes that energy efficiency is a key priority, it is currently unclear that this is so (see section 6), although there are some indicators to suggest that this may change. In sum, in South Africa CDSM is currently being under-invested in – partially because there appear to be very few institutional players taking primary responsibility for promoting, driving and supporting this process.

3.3.3 Some commercial ventures misunderstand the notion of 'energy efficiency'

Many commercial enterprises (and the architects and planners thereof) are unaware that energy-efficiency-type DSM need not bring about a reduced level of service. It is also seen widely as being a costly venture with few noticeable benefits. This limited understanding of DSM significantly impedes investment in this area.

3.4 Conclusion

If Eskom and municipalities and the NER are to be serious about promoting DSM in the residential, industrial and commercial sectors, it is in their interests to ensure that programmes are geared towards removing or at least reducing these customer-related barriers. Clearly, if they are not addressed, the likelihood of customers not investing in DSM will remain high. No matter how 'big' the project is, how many resources the project employs, how wide its outreach is, it will not be successful if these barriers are not seen to. Thus, it should be taken for granted that, in designing DSM programmes and regulations, government and municipalities and the NER face each of these customer barriers in addition to those specified below.

4. Municipal DSM investment

Section 4 reviews current DSM initiatives at the municipal level. It looks at how municipalities manage their wholesale electricity purchases from Eskom with a view to minimising their electricity bills, and then focuses on the range of DSM initiatives they use to manage their electricity sales to their customers. Against this background, this section then explores the barriers to DSM at the municipal level.

4.1 Current DSM initiatives

There are two crucial 'interfaces' when it comes to DSM at the municipal level. The first is between Eskom Distribution and the municipality. All municipalities have to purchase the electricity they distribute from Eskom Distribution. To limit the size of their electricity bills from Eskom they seek to manage their peak demand, as this is the principal determinant of the rate at which Eskom charges them. The second interface is between the municipality and its customers. This relationship is rather ambiguous. On the one hand, municipalities have a definite incentive to promote electricity sales in order to maximise revenues and this undermines the incentive to encourage end-use efficiency. On the other hand, for municipalities to minimise costs and maximise profits they need to get their customers to shift consumption to off-peak times so as to reduce peak demand with Eskom. This is done using DSM tools such as time-of-use tariffs and interruptibility. Some of these measures result in more efficient energy use but this benefit is generally seen as an unintended consequence.

Municipalities may also seek to use DSM tools to postpone investments to strengthen distribution networks. However there is a definite bias among municipal electricity departments to upgrade networks as soon as it is necessary rather than try to delay the process by investing in DSM. There would also appear to be a bias towards requiring developers to over-invest in network capacity on new developments so as to reduce future maintenance costs for the municipality.

Some municipalities do offer their larger customers advice on how to improve their energy use efficiency, but the service is by no means well developed. Often the advice is limited to marketing one or other DSM tool, such as a time-of-use tariff. Most municipalities are also involved in educating the public regarding the use of electricity. However, in nearly all instances the focus is primarily on safety issues and on the customers' payment obligations, and less on encouraging efficient energy use.

To sum up, there are four possible reasons why municipalities undertake DSM:

(i) as a means of managing their load profile and therefore their electricity bill from Eskom Distribution;

(ii) as a means of avoiding making network investments;

(iii) as part of a package of energy services they offer to their customers; and

(iv) as a public service aimed at improving energy efficiency.

The sections that follow explore what municipalities do about DSM in practice.

4.1.1 Managing wholesale purchases from Eskom

All municipalities have to purchase the electricity they distribute from Eskom Distribution, unless they generate it themselves. Regulations prevent them buying electricity from each other, from IPPs or from industries with cogeneration. Eskom Distribution offers a suite of electricity tariffs to municipalities. Since the early 1990s Eskom has sought to manage its system load by introducing tariffs that include time-of-use variables. This trend is likely to be reinforced by recent developments in government policy thinking, which emphasises that tariffs must be 'cost-reflective'. As a result, time-of-use variables are likely to become even more important.

In managing their wholesale electricity purchases, municipalities face a number of options. They need to choose the supply tariff which best suites their circumstances. If they have own generation, they need to determine how to use it optimally. And they need to decide on the use of DSM measures to limit their peak demand and to shift consumption to low-cost periods.

4.1.1.1 Choice of supply tariff

The electricity tariff that Eskom Distribution charges a municipality forms the basis on which that municipality evaluates the economic and financial viability of any DSM initiatives. The kind of tariff also plays an important role in determining which DSM tools the municipality can use (and will use) to manage its electricity sales. For certain municipalities the choice of tariff is influenced by the kinds of DSM tools it already has available. Other important variables in this choice include the municipality's size, customer base, demand profile, infrastructure and capacity to manage peak demand.

Most of the large municipalities are currently on the 'Megaflex' tariff as this allows them to pass time-of-use benefits on to their larger commercial and industrial customers. Smaller municipalities are generally on one of the 'maximum demand' tariffs. Their scope to move to a time-of-use tariff is limited by their technical capacity to administrate such a tariff, the lack of metering infrastructure and the fact that few of their customers can benefit from it.

It is evident that larger municipalities are in a far stronger position vis-à-vis Eskom Distribution when it comes to negotiating 'special deals' on tariffs. Not only are they key customers and it is therefore in Eskom's interests to look after their interests, but they also have the economic and political clout, the technical expertise and capacity to negotiate with Eskom. In contrast, the smaller municipalities are less able to assess and protect their interests. Unless they act collectively, they have little option but to accept the regulated terms of supply Eskom Distribution offers them.

The larger municipalities with own generation are in a particularly strong position when it comes to negotiating tariffs. In the past they were offered 'special deals' by Eskom to discourage them from using their capacity. Such deals still exist, but are no longer as generous, partly because of a decline in Eskom's excess capacity, and partly because of the NER's insistence that all tariffs, including such deals, must be cost-reflective. The fact that Eskom's generation and distribution activities have been ring-fenced also means that there is now less scope for transferring the benefits of such deals from the distribution end of Eskom to its generation operations.

Many municipalities are looking forward to the development and implementation of a wholesale time-of-use tariff based on real-time marginal costing. There is a general perception that they would be able to pass the advantages of such a pricing regime on to their customers. In other words, such a tariff would provide the correct incentives for economically efficient DSM. However, there does not appear to be much appreciation of the risks of introducing such a pricing system into an industry structure where Eskom Generation is the dominant player.

4.1.1.2 Use of own generation

Very few municipalities have own generation, and those that do generally use it for peak lopping. In other words they compare the cost of *purchasing* electricity from Eskom Distribution with the cost of *generating* it themselves and when their own generation is cheaper they use it to displace purchases from Eskom. Despite the fact that most municipal coal-fired power stations are more expensive to run than Eskom Generation's power stations, municipalities are able to make a good return on own generation during peak consumption times, because of the way Eskom Distribution's tariffs are currently structured. The fact that all the municipal power stations concerned are fully paid for also helps. Another important consideration is that these power stations are specifically designed for 'peaking' and can therefore track a local demand peak far more closely (and possibly more cost-effectively) than one of Eskom Generation's enormous 'base load' stations.

This form of 'peak lopping' is strictly speaking not DSM as it simply involves replacing one source of generation with another without changing the actual end-use demand for electricity. However, viewed from the municipalities' perspective, they are using their own generation to manage their demand vis-à-vis Eskom. They could invest in more traditional DSM initiatives and achieve much the same effect. Whether a municipality sheds load by switching off geysers or using own generation, the outcome for Eskom Generation is the same: it needs to bring less capacity on-line.

However, if DSM is regarded as a means of fostering greater efficiency in the use of *national resources* then using what are arguably less efficient municipal coal-fired power stations instead of more efficient Eskom stations undermines the aims of DSM. Indeed, the five municipalities that use their coal-fired power stations for peaking openly admit that it is only financially viable to do so given the current structure of electricity tariffs. They do not pretend to be able to compete with the *generating costs* of Eskom Generation's power stations, but they can compete with Eskom Distribution's *delivery price* to them.

Using hydroelectricity or pumped-storage capacity to replace Eskom Generation's capacity falls more comfortably within the parameters of DSM. There are only three municipalities with hydroelectric plants. Their total capacity is just 4MW, but for the municipalities concerned the benefits of owning these plants are significant. Due to the nature of the systems they tend not to be used strategically for peak lopping, but are simply allowed to run whenever water is available. Ceres Municipality feeds the electricity it generates with its hydro plant directly into the Eskom transmission system. Eskom measures the number of units received and credits them to the municipality's electricity bill. It was not clear whether the hydroelectric plant's output was deemed to reduce the municipality's maximum demand as well.

The use of Cape Town's Steenbras pumped storage capacity enables the municipality to shift peak demand from Eskom Distribution to off-peak periods. As a result, Cape Town Municipality's demand profile vis-à-vis Eskom Distribution is reported to be 'as flat as Table Mountain' and therefore very cost-efficient. The municipality claims to pass this benefit on to its customers.

The municipalities that have own generation have no doubt about the value of it. Not only have they used their own generation to keep prices to their own customers down by peak lopping, but they have also used their generation as the basis for negotiating 'special deals' with Eskom. Towards the end of the 1980s and early 1990s Eskom concluded a series of 'capacity displacement deals' with municipalities with own generation in order to allow it to use more of its own enormous excess capacity. Some people are of the opinion that Eskom was in fact trying to use these 'special deals' to close the municipal power stations down. The fact that the Port Elizabeth Municipality was unable to bring its Swartkops power station back on-line after the termination of such a deal is cited as a 'success' of this strategy. Other municipalities worked very hard to keep their power stations operational and so were not 'caught out' when the deals ended or renegotiated.

4.1.1.3 Second best DSM investment

As noted above, municipalities undertake DSM primarily as a means of managing their demand profile vis-à-vis Eskom with a view to improving the cost-efficiency of their electricity bills. Many

larger municipalities regard DSM as a second-best solution, and would prefer to have been allowed to invest in peak-lopping generation capacity, which was not possible given Eskom's legislative monopoly over building new generation capacity. Municipalities therefore had no option but to invest in DSM. The focus of such investments was on DSM tools aimed at shedding peaking load, most often ripple control. More recently municipalities have begun to offer time-of-use tariffs in response to the tariff incentives they receive from Eskom Distribution. Few municipalities seem to consider DSM initiatives for reasons other than to manage their peak demand. It is also notable that nearly all the municipalities that have own generation do not have ripple control.

4.1.2 Load shifting and strategic growth

Opportunities for significant load-shifting and strategic growth are usually specific to particular industries. Mines and smelters are typical examples of industries that can shed load, or take advantage of low-cost electricity at strategic times. However, most manufacturing and commercial enterprises operate 8am to 5pm and to reorganise their work-schedule is simply neither practical nor financially viable. In nearly all instances the wages associated with shift work would far outweigh any savings on electricity.

Eskom Distribution supplies most of the largest mining and metal industries directly, and has put in place the appropriate incentives and agreements to encourage load-shifting and strategic growth. Municipalities generally supply industrial and commercial customers that operate normal work-hours and so the scope for load shifting is necessarily limited. It tends to be even more limited when it comes to domestic customers. Nevertheless, most of the larger municipalities have put in place incentives to encourage load shifting.

4.1.2.1 Time-of-use tariffs

The most common incentive used by municipalities to encourage load-shifting is the time-of-use tariff. Most municipalities use a simple two-bloc system with low tariffs at night and higher tariffs during the day. Some have moved to a three-bloc system in line with the Megaflex tariff, i.e. peak, standard and off-peak rates. These tariffs are available to any industrial or commercial customer that can show it is in their interests and that has a demand greater than a given level – usually 1 MW. It is notable that the structure of these time-of-use tariffs differs widely across municipalities. For instance, in Kimberley the night-save tariff is applicable from 6pm to 8am, whereas in Cape Town it is only available from 11pm to 6am.

The uptake on these tariffs varies from municipality to municipality depending on their customer profile. Most of the municipalities interviewed reported very low take-up rates. For instance, in Cape Town 'only a handful' of the nearly 600 industrial customers had taken advantage of the night-save tariff. Durban Municipality seems to be most proactive in promoting its time-of-use tariffs: providing dedicated customer support and even encouraging smaller customers to move to it. Apparently Durban Municipality would like to extend time-of-use tariffs to all its customers, but the availability of appropriate meters is an obstacle.

It is not clear whether customers who move from a normal tariff to a time-of-use tariff actually shift load. The view was expressed that most customers probably realise savings due to the lower cost structure of time-of-use tariffs rather than due to any change in their electricity consumption pattern. It was nevertheless accepted that moving to a time-of-use tariff was a necessary condition for encouraging load-shifting in future, and that when such customers began to look for ways to cut production costs load-shifting was now one of the options they could consider.

It is notable that nearly all the time-of-use tariffs offered by municipalities to their customers are similar to the structure of the time-of-use tariffs they receive from Eskom Distribution. Clearly municipalities are passing the benefits (and costs) of the wholesale tariffs on to their customers.

4.1.2.2 Tariffs for limited loads

Certain municipalities offer their customers different tariffs for different load options. They use circuit breakers to enforce these options. So a customer who chooses 20 amps and tries to consume more than this will trip their supply. It could not be determined how widespread these

tariff options are, or whether they make a significant contribution to DSM. It would seem that Ceres Municipality used these tariffs to good effect as part of a broader DSM programme aimed at postponing the need to upgrade its supply link with Eskom. By contrast Durban Municipality has decided to install 40 amp circuit breakers across the board, given that they cost the same as 20 amp ones. This undermines any scope for tariff differentiation.

4.1.2.3 Ripple control tariffs

While many municipalities use one or other method for switching geysers on and off, very few seem to give their customers the right to choose whether they want the functioning of their geysers interfered with in this way. Indeed the view was expressed that the beauty of ripple control is that the municipality can use it to make savings without the knowledge of the customer. Of the municipalities interviewed only Centurion offers its customers the right to choose to be part of the system or not. If they choose to leave the system the municipality adds between R50 and R70 per month to their electricity account. In addition these contracts apply for a full year to prevent people leaving for winter and joining for summer. There is thus a clear incentive not to leave the system. It is reported that only about 0.5% of domestic customers have opted to do so.

4.1.2.4 Load factor correction and control

All municipalities recognise the value of load factor correction and control, and most have invested in it as the payback is virtually immediate. It is interesting to note that Ceres Municipality used load factor corrections and load-breakers to successfully delay investment in upgrading the town's link with Eskom by about three years.

4.1.2.5 Pumped storage

The Cape Town Municipality's Steenbras power station uses cheap nighttime electricity to pump water up the mountain so that it can be used to generate electricity during peak times. Although the process involves a substantial net energy loss, the overall effect is to shift load (vis-à-vis Eskom Distribution) from peak to off-peak times. It could also be treated as an example of strategic growth as increases the city's night-time energy demand.

4.1.3 Interruptibility

At the municipal level, DSM based on interruptible electricity service is almost totally confined to controlling the functioning of geysers. Some municipalities can also switch off their streetlights to shed load. None of the municipalities interviewed mentioned the kind of interruptible contracts that Eskom Distribution has with certain of its large mining and metal smelting customers. Indeed Cape Town Municipality noted that it sought to guarantee its industrial and commercial customers 100 per cent security of supply.

4.1.3.1 Ripple control on geysers

Many medium and large municipalities have systems in place to manage their domestic customer's geysers. Notable exceptions are those that have access to own generation. Among smaller municipalities the evidence is mixed. Those interviewed indicated that they could not install such systems due to a lack of capital needed to make the initial investment. There was, however, general agreement that 'ripple control' is economically viable.

A notable exception to this view is Durban. From the municipality's perspective Eskom Generation has most to gain from a ripple control system in terms of avoided costs of new generation, and should therefore pay for the investment. Given Durban's current tariff with Eskom Distribution the potential savings for the municipality are not sufficient to justify investment in a ripple control system. Another factor that reduces the viability of a ripple control system is the fact that the water entering geysers in the Durban area is substantially warmer than inland. This means geysers do not switch on as often and use less energy to heat the water.

Of the municipalities interviewed, Centurion seems to have the most proactive ripple control programme. It involves actively managing peak demand, offering customers on opt-out tariff, and systematically extending the system to all new houses. The other municipalities use their

existing systems, but are not as proactive in extending them. As a result they have substantial installation backlogs, which detracts from their overall efficacy.

Municipalities use a range of technologies to control geysers. Worcester uses radio-controlled switches, other municipalities use a variety of ripple control technologies. Kimberley is finding that its existing 'old' system is becoming expensive to maintain and is considering switching to a system that has more cost-effective backup from suppliers.

Municipalities with systems to manage geysers report substantial benefits. For instance, Kimberley is able to shed between 6 to 8 MW of load with its system, which is between 8 and 10 per cent of the city's maximum demand.

4.1.3.2 Switching off streetlights

Some municipalities are able to shed load by switching off their streetlights with their ripple control systems. This form of DSM is only used in emergencies, and usually does not affect streetlights along main access routes. In the last eight years, Centurion has only used the system twice.

4.1.4 Energy efficiency

As noted above, municipalities generate revenue from electricity sales. It is therefore not in their interests to foster end-use energy efficiency. Consequently, municipalities do not give much attention to efficiency-oriented DSM measures either in terms of personnel capacity or in terms of investment.

4.1.4.1 Education

Most of the larger municipalities have community or school outreach programmes aimed at disseminating information about electricity use. They rarely employ more than two or three information officers for areas as large as Cape Town or Durban. Kimberley Municipality has been more proactive than most, and is in the process of buying a bus which it will kit out with various demonstrations for taking round to schools.

The programmes generally target newly electrified communities and schools in poorer areas. The focus of the education effort tends to be on safety issues, uses of electricity and the operation of the pre-payment meters. Efficiency issues are addressed, but the aim is to educate people about electricity generally, rather than focussing their attention on efficient electricity use specifically. Indeed, the net effect of these educational efforts is often to get people to switch from using other energy carriers for, say, cooking to electricity, because it is a safer, cleaner, healthier source of energy.

Most of these programmes are run in partnership with Eskom. It is generally felt that Eskom should take the lead in such education initiatives as it has the capacity and the resources to do so. Indeed, the only education initiatives undertaken by many smaller municipalities involves forwarding Eskom pamphlets to their customers.

4.1.4.2 Customer services

A number of the municipalities have customer service officers who visit and advise larger commercial and industrial customers regarding the efficient and effective use of electricity. The level of service is, however, fairly rudimentary and in many instances confined to advising about different tariff options. Some officers are able to advise on the cost effectiveness of different energy use options or on ways of saving electricity, e.g. the use of timers on heating equipment in the hotel industry.

Of interest in this regard is the view expressed a number of years ago by the Cape Town City Council (as it was then) that these services are available from consulting engineers and that it would be unfair competition for the council to offer such services as well. Other municipalities have pointed out that far from competing with the private sector, their officers often generate work by making clients aware of options and then referring them to the private sector for further advice and implementation.

4.1.4.3 Urban planning and building design

None of the municipalities interviewed appear to have any policies, regulations, recommendations or initiatives aimed at ensuring or promoting energy-efficient urban plans or energy-efficient buildings. As far as could be determined, there is minimal interaction between the urban planning department and the electricity department: the latter simply 'wire' the areas that the former lay out. There was nevertheless appreciation of the fact that greater interaction and co-operation would be beneficial, and in fact is a necessary dimension of integrated development planning (IDP) and integrated resource planning (IRP).

As regards low-cost housing developments, it would appear that nothing is being done by municipalities to promote the development of energy-efficient housing stock. No effort is even being made to ensure that at least the most basic things are done – such as orienting the houses correctly. It is argued that the over-riding consideration is to maximise the number of houses built and the amount of floor space covered by a roof, within the given subsidy, and that any other consideration would simply increase costs.

4.1.5 Other developments that have DSM outcomes

A number of developments in the electricity distribution industry at the municipal level have had unintended DSM outcomes. It may be that in future these DSM outcomes, now that they have been identified, will feature more prominently in decisions regarding these developments.

4.1.5.1 Pre-payment meters

All municipalities have opted to install pre-payment meters in newly electrified, low-income houses. The primary motivation is to ensure security of revenue and avoid bad debts. Cape Town has gone one step further and is seeking to shift all domestic customers onto these meters. Thus far 200 000 of the 380 000 customers are now on pre-payment meters. It has been observed that their use raises households' awareness of their electricity consumption and thus encourages them to use it more efficiently – switching off lights, using the microwave and not the stove, etc. It is estimated that households with pre-payment meters consume at least five per cent less electricity than would otherwise have been the case. This is a substantial saving given the number of households involved.

Other municipalities are not as enthusiastic to move all their customers onto pre-payment meters. Most will allow existing customers to switch, but the customer has to pay for the meter and the installation. These municipalities prefer the old mechanical credit meters because they are more durable and cost less to maintain. It is reported that the electronics in pre-payment meters only last about six years, while the mechanical metres last for 40 years and more. Also, the electronics in the pre-payment meters are particularly susceptible to damage by lightning and so are not suited to areas with a high incidence of electrical storms.

4.1.5.2 Consolidation of municipal distribution networks

In certain regions the consolidation of urban municipalities into metropolitan structures has resulted in the consolidation of municipal distribution networks, and the consolidation of the various municipalities' contractual relationships with Eskom Distribution. So, for instance, instead of the Pretoria, Centurion and Acasia municipalities each purchasing electricity from Eskom Distribution separately, the Pretoria Metropolitan Council now buys electricity on their behalf. This benefits the different councils in a number of ways:

(i) The different councils' peak at slightly different times and so consolidating their demand creates a more efficient demand profile.

(ii) By consolidating the consumption of the municipalities the metro council can purchase bulk electricity from Eskom Distribution at a lower unit charge.

(iii) Councils that previously did not have access to own generation have joined systems with own generation and so can benefit from peak lopping.

(iv) By joining together, the municipalities have diversified their collective customer base which has resulted in a more cost-effective demand profile.

The bottom line is that consolidating different municipalities' electricity demand profiles and customer bases offers scale advantages for DSM. By consolidating their interests the municipalities have also strengthened their bargaining position vis-à-vis Eskom Distribution.

4.1.5.3 Restructuring uncertainty

While the changes to the structure of electricity management that have taken place in metropolitan areas have had positive outcomes for DSM, the ongoing uncertainty around the restructuring of the electricity distribution industry is having the opposite effect. Municipalities are not taking investment decisions regarding DSM because they are not certain whether they will benefit from such investments if their distribution businesses are transferred to REDs. The result is that backlogs in DSM investment are developing, for example in the installation of new geyser controls in Worcester.

4.2 Barriers inhibiting municipal investment in DSM

This section explores barriers to DSM at the municipal level. It is important to note that these barriers are often interrelated and that it is the cumulative effect of a number of barriers that actually prevents investment in DSM, as opposed to the individual impact of any single barrier. Having said this, it is also true that, while the removal of certain barriers may be a necessary condition for DSM, it may not be enough. There are certain key barriers, more particularly those of an economic and technical nature, that have to be overcome to create sufficient conditions for DSM, that is, circumstances in which DSM *can* and *will* actually occur.

4.2.1 Information barriers inhibit investment in DSM

Lack of information and poor information dissemination are together probably the most important barriers to DSM at the municipal level at present. In a very real sense overcoming the information problem must be the first step to overcoming many of the other barriers.

- *Lack of information*. In the first instance, most municipal electricity departments do not gather appropriate technical and financial information on the operation of their distribution networks and energy consumption patterns of their customers. Without this information it is impossible to assess the economic (and financial) viability of DSM measures, or compare the cost-effectiveness of DSM spending versus, say, network development. Even where such information is collected it is often of such poor quality that it can not be used.

  To aggravate the situation further, many municipal electricity departments are not fully informed on different DSM opportunities, methods and tools, their benefits and costs and how they are implemented. Most of them perceive DSM as just referring to a handful of direct load control tools, and thus overlook consumer energy-efficiency measures, thermal energy storage options and lost opportunity measures in equipment purchases, building design and urban planning. Being unaware of these options means they do not know what kinds of information they should be collecting in order to evaluate such DSM opportunities. A further problem is the fact that few municipalities have the financial resources to collect such information, or the in-house expertise/capacity to manage and utilise it effectively.

- *Poor information dissemination*. The second aspect of the information problem relates to the dissemination of information about DSM. Poor understanding on the part of decision-makers, particularly councillors, of what DSM is and what benefits it holds, impacts on the priority it is given in municipal policy, planning and investment decisions. Current efforts by municipal electricity departments to communicate the benefits of DSM to councillors are woefully inadequate. It would appear that Kimberley is one of the few municipalities making a concerted effort to address this problem.

  Similarly, poor understanding on the part of customers impacts on the level of public support for DSM initiatives, the take-up of DSM measures, the level of public participation in energy-saving initiatives, and the kinds of mandates voters give their public representatives. Again current efforts to educate the public on DSM measures leave much to be desired.

- *Lack of comparative information.* An important spur to DSM at the local level could be the publication of data on how the municipalities are performing in this area. At present no information of this kind is made publicly available, and so the public and councillors cannot use it to measure the performance of their local municipal electricity departments. The view was also expressed that managers at the municipal level operate in a vacuum not knowing whether they are performing well or not, and therefore with little incentive to improve.

4.2.2 Methodology used to evaluate the viability of DSM is unsatisfactory

Under normal circumstances the fact that it does not make economic sense to invest in a particular DSM measure cannot be counted as a barrier to DSM generally. It simply means that that particular investment is not a cost-effective or efficient use of scarce resources at that time. However, a range of factors can impact on the outcomes of economic or financial evaluations of possible DSM investments, including:

(i) the way costs and benefits of DSM initiatives are measured or calculated;

(ii) the types of costs and benefits taken into consideration in their evaluation;

(iii) the kinds of projects to which DSM measures are compared; and

(iv) from whose perspective the costs and benefits of DSM are evaluated.

The methodology used to assess the viability of DSM can therefore be a significant barrier to its wider adoption.

At present, feasibility studies of DSM measures focus on financial viability from the municipal perspective. This creates a bias against such measures whose main benefits arise from:

(i) capacity savings for system wide generation and transmission;

(ii) cost-savings for customers due to lower electricity consumption; and

(iii) positive environmental impacts benefiting the whole of society.

None of these benefits are taken into consideration by such evaluations of financial viability. Indeed, some of these benefits may even be counted as costs from the municipal perspective – for example, the loss of revenue due to decreased sales resulting from improved consumer energy efficiency.

Furthermore, municipalities' capacity to compare the costs of DSM interventions in the current period as a means of postponing network investments is limited. As a result, the benefits of such DSM measures tend to be undervalued. Consequently, network investments are probably being made far sooner than is necessary at great expense to both municipalities and their customers.

The *White Paper on Energy Policy* proposes the use of IRP at both national and local level as a means of standardising the methodology used to evaluate energy-related developments, including DSM. However, a tremendous amount of work still needs to be done to ensure that IRP does indeed lead to greater standardisation in cost-benefit analyses and feasibility studies.

4.2.3 Profit orientation of municipal distributors detracts from DSM focus

Many municipalities generate significant surpluses on their electricity distribution activities. Whether these surpluses are treated as profits, dividends or tax revenues, the fact remains that they are an important source of income. To maximise this income municipalities have a strong incentive to maximise electricity sales (for a given tariff) and minimise their system costs, including the cost-effectiveness of their load profile. As a general rule, therefore, municipalities face positive incentives when it comes to DSM measures that focus on load management such as ripple control. And they face negative incentives when it comes to DSM measures that improve customer energy efficiency, and thus reduce sales.

This bias towards DSM measures that focus on load management is very noticeable among municipalities. Indeed, none of the municipalities interviewed have programmes aimed specifically at encouraging energy efficiency among their customers. Particularly noticeable is municipalities' complete failure to give attention to capturing the lost opportunity savings in the

construction of new low-cost houses. The simple fact is that they have no incentive to ensure that such savings are captured.

4.2.4 Eskom Distribution's tariff structure does not always 'make local sense'

The time-of-use tariffs that Eskom Distribution uses are based on the daily and seasonal demand profiles of the national system. It is designed to give price signals in such a way that electricity demand during system peak periods is penalised and use in system off-peak periods is encouraged. However, local system demand profiles may deviate substantially from the national system demand profiles for a variety of reasons. While the Eskom seasonal system peak is in winter, Ceres, for instance, has a summer peak because of a large fruit processing industry in its area. Durban and most other coastal towns also have summer peaks due to the influx of visitors for the summer holidays. Where Eskom's time-of-use tariff does not coincide with local load profiles it will not provide accurate incentives for DSM in those municipalities.

Eskom Distribution's tariffs for municipalities do not necessarily reflect the local cost of delivering electricity to them. For instance, there are cross-subsidies between regions to cover differential transmission costs. As above, the outcome is that these tariffs do not give municipalities accurate price signals by which to evaluate DSM or alternative supply options (e.g. cogeneration). This may lead to under-investment in DSM in some areas.

4.2.5 The cross-subsidisation of other services disincentivises DSM

Municipalities use the income they generate from electricity sales to cross-subsidise other services. As a result, municipal electricity tariffs are higher than if they only reflected the cost of electricity services. From an end-user's perspective this makes DSM measures that improve energy efficiency look more attractive, and there may be limited additional private investment in energy efficiency as a result. However, large municipal investments in energy efficiency are unlikely because such measures would reduce electricity sales and thus deprive the municipality of the income it uses to pay for other services. The practice of cross-subsidising other services from electricity sales therefore creates a powerful disincentive for municipalities to become involved in programmes promoting energy efficiency.

4.2.6 Electrification investment cost-recovery disincentivises DSM

Electrification requires substantial capital investment. When Eskom and the municipalities embarked on the electrification programme they hoped to recover these investments via electricity sales to the newly connected customers. However, the new customers' electricity consumption has been far lower than expected; as a result the level of cost recovery has been well below that planned for. This has placed tremendous pressure on both Eskom's and municipalities' financial resources. One way to relieve this pressure is to encourage new customers to increase their electricity consumption. Much of the customer education that is currently being undertaken seems to have this as one of its objectives. For instance, electrical appliances are promoted as safe, clean alternatives to, say, paraffin appliances. In the past both Eskom and municipalities have also sought to facilitate poor households' access to appliances that use large amounts of electricity via the so-called 'white goods' programmes.

Where electrification is treated as a social investment and the initial capital costs are financed by grant funding either from national government or foreign donors, municipalities do not need to recover such costs via electricity sales. However, municipalities still need to sell enough electricity to cover the maintenance costs of the new networks. There is thus still some pressure on municipalities to encourage new customers to increase consumption.

This drive to bring electricity sales to new customers up to 'economic levels' is in direct opposition to any DSM initiative to increase energy efficiency.

4.2.7 Current structure of the EDI is seen to disfavour municipalities

There is a strong feeling among municipalities that the current structure of the electricity distribution market allows Eskom Distribution to 'cherry pick' the largest customers. For instance, it is claimed that Mondi is locating a new paper mill in Richards Bay because Eskom Distribution offered them a lower tariff there than the Durban municipality could offer them at their existing site in Durban. Another alleged example of unfair competition by Eskom

Distribution is the way it prevents Kimberley Municipality from supplying electricity to the diamond mines in the Kimberley district. Eskom has used its legislative monopoly to retain the right to supply even those mines immediately adjacent to the town. This not only deprives municipalities of sales, but also prevents them benefiting from the economies of scale associated with servicing large customers. It also means that they tend to be stuck with customer bases dominated by domestic customers. These factors tend to limit municipalities' scope to undertake effective DSM. They simply do not have the scale or the diversity needed to make DSM work.

4.2.8 Smaller municipalities cannot reap 'economies of scale' benefits of DSM

The majority of municipalities are so small that they lack the economies of scale to make investment in DSM programmes cost effective. For Loxton, with its eighty customers and thirty-six streetlights, to contract anyone to advise them on DSM opportunities would simply not be viable. Hundreds of municipalities are simply not large enough to justify employing suitably qualified personnel to manage DSM. Even the largest municipal distributors, such as the Pretoria Metropolitan Council, believe there are still scale advantages to be had from consolidating its network with surrounding distribution networks. It is argued that, because the demand peaks in the surrounding networks occur up to an hour earlier than the central area's peak, consolidating the peaks will enable more effective load management.

4.2.9 Municipalities do not pay for standards

Municipalities are responsible for specifying network standards for new developments, which the developers have to comply with and pay for. The fact that the municipalities do not have to pay the cost of meeting these standards means that they tend to require higher standards than are necessary. This reduces their maintenance costs, and reduces the likelihood of them needing to strengthen the network as demand increases. This situation also undermines all incentives for the municipality to undertake DSM (a) to save costs on the initial network investment, and (b) to avoid having to upgrade the network in response to growing demand.

4.2.10 Competing priorities for capital detract from investments in DSM

Many of the municipalities interviewed indicated that the capital to invest in DSM is not available. Either they are already heavily in debt, or they have allocated their capital for use on other social investments. It was noted that, although DSM may in fact give municipalities a better return than other projects, most councils' investment priorities are biased towards delivering 'visible, voting winning goods' as opposed to ones that save money or generate income.

4.2.11 'Installing' DSM is expensive

It would seem that nearly all the 'technical' barriers to DSM at the municipal level revolve around the cost of installing the necessary equipment for DSM, as opposed to insurmountable technological obstacles that require some 'new way of doing things' to be discovered. For instance, Durban Municipality noted that it would like to extend time-of-use tariffs to all its customers, but is unable to do so at present because the appropriate metering equipment is not in place. It is not that the equipment cannot be obtained, but the cost of doing so is too high.

Another possible technical barrier cited relates to the use of pre-payment meters. As noted above, these raise customers' awareness of energy efficiency. However, many municipalities prefer not to install them because they are less reliable and more prone to lighting damage than the mechanical credit meters. So, by avoiding the maintenance costs associated with pre-payment meters, municipalities fail to capture the DSM benefits associated with their use.

4.2.12 Regulations governing the structure of the electricity industry hinder DSM investment

There do not appear to be any regulatory barriers that hinder DSM at the municipal level directly. There are, however, regulations governing the general structure and operation of the electricity industry that impact negatively on DSM at the local level. The fact that municipalities are not allowed to buy electricity from each other, from IPPs or from industries with

cogeneration is one example. The obstacles in the way of municipalities building their own generation capacity is another.

It is also not clear whether the current drive towards standardising tariffs across the country takes account of regional differences in costs of delivery. If it does not, then this will tend to skew incentives for DSM.

4.2.13 Municipalities lack capacity to invest in DSM

The lack of capacity is one of the obstacles to DSM identified by all municipalities. This lack of capacity takes two forms: firstly, municipalities lack the institutional capacity to take the kinds of relatively sophisticated decisions associated with DSM. For instance, few are structured in a way that facilitates different departments working together. Instead, each works within their own silo. The result is that cross-sectoral issues such as DSM, water efficiency, and other environmental issues rarely get adequate attention. This lack of institutional capacity also manifests itself in the way the new housing developments are being handled. In most instances, the municipalities make minimal input and allow the developers to drive the process as they wish. As a result, issues such as the orientation and thermal efficiency of the new houses are completely ignored.

Secondly, municipalities lack suitably qualified personnel to drive DSM. Many cannot afford to employ additional people, for others DSM is simply not an activity on which the council is prepared to spend resources. Many municipal electricity departments mentioned that their councils would not even allow them to employ additional staff to run customer outreach programmes.

4.2.14 DSM investment does not fall within urgent political priorities

The councillors have to be 'seen to be delivering' on the mandates they received from the electorate. Most voters want to see concrete developments in a very literal sense, and the local politicians respond to this by channelling municipal investments towards projects that deliver tangible outputs such as housing, sewerage systems, roads, water systems, stormwater systems, etc. The emphasis is on projects that are 'vote catching', and the stark reality is that DSM does not fall into this category even though it may in many instances offer municipalities a good return on their investment.

4.2.15 There are few champions for DSM

DSM does not take place unless it is driven by either a person with vision, or as part of the organisational vision. Very often the two are linked. If someone in an organisation appreciates the benefits of DSM and has a vision for DSM, the organisation often moves in that direction as well. People with a vision for DSM are hard to come by in the municipal sector, and even those that are there find it difficult to carry their departments and councils with them, given that these are focusing on other priorities.

The situation is currently aggravated by the uncertainty that surrounds the future structure of the electricity distribution industry and the status of municipal distribution assets. Councils appear to be unwilling to invest resources in programmes that will be transferred to REDs. By the same token, people in the electricity departments are bracing themselves for the changeover, and are therefore not looking towards developing ideas and plans that are unlikely to get much support in the current set-up. Some people expressed the view that once the REDs come into operation they will be set free to pursue DSM, so long as they can show it makes financial sense.

4.3 Conclusion

Municipalities currently focus primarily on DSM measures that allow them to manage their load profiles vis-à-vis Eskom Distribution. Their aim is to maximise the cost-effectiveness of their electricity bills. In many instances there is a direct relationship between the kinds of DSM measures adopted by municipalities and the structure of tariffs they receive from Eskom Distribution. Because municipalities generate income from the sale of electricity they tend not to pay much attention to DSM measures that encourage energy efficiency.

Information and economic barriers to DSM seem to predominate at the municipal level. In many instances, DSM is not undertaken because of a general lack of information or because the way it is costed does not reflect costs and benefits accurately. Another important obstacle to DSM is the fact that councils' investment priorities are strongly influenced by the need to win votes. The uncertainty about the impact of restructuring on municipal distribution assets is also a factor. The lack of public awareness about energy efficiency is another obstacle that is not being adequately addressed.

To what extent the above-mentioned barriers to DSM will persist after the restructuring of the electricity distribution industry needs to be explored. It is possible that many of them may disappear, especially those resulting from uncertainty and lack of economies of scale. However, others may emerge as distribution entities become more commercially orientated. The impact of restructuring the electricity distribution industry on DSM also needs to be assessed within the context of broader electricity industry restructuring and the impact this may have on incentives to carry out DSM.

5. Eskom's DSM investment

5.1 Integrated electricity planning

In 1992, integrated electricity planning (IEP) was initiated in Eskom. IEP in Eskom is defined as the process which selects from a full array of demand- and supply-side options, the least-cost combination of actions, risks and investments, which:

- satisfies customer's electricity needs in terms of quantity and quality of supply;
- achieves optimal value for the customer;
- is financially viable for Eskom;
- is compatible with Eskom's strategic direction.

The present Integrated Electricity Plan, called IEP7a, represents the seventh plan since the inception of IEP.

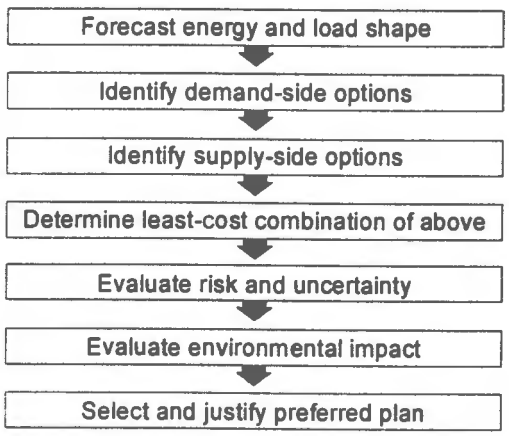

Figure 2: IEP process
Source: Eskom (1997)

The Demand-side Working Group is responsible for providing the DSM alternatives to system expansion for the IEP process, as well as for developing an overall DSM strategy based upon IEP analysis. These alternatives fall under the subcategories of 'strategic load growth', 'load shifting', 'interruptibility' and 'energy efficiency' and are outlined below:

5.1.1 Strategic load growth

In addition to Marketing's ongoing sales initiatives, the following three important opportunities for strategic load growth interventions were identified in IEP6. These included:

- *Surplus energy deals.* This short-to-medium-term opportunity allows for energy sales of approximately 3 000 GWh per annum to be sold on a competitive bid basis and through special discounted deals. Electricity sold is on a non-firm and interruptible basis and customers are required to demonstrate that all surplus energy purchased is used in addition to electricity purchased under a normal 'tariffing' environment.
- *Dual fuel systems.* According to this option, the operator of a duel fuel system is able to select which of two energy forms (electricity and one other energy carrier) is to be used by the energy system at any point in time. Significant opportunities are thought to exist for the introduction of such systems into energy-intensive processes such as steam-raising. Such electricity sales are fully interruptible and make optimal use of off-peak capacity. A strategic load growth target of 1500 MW (10 000 GWh per annum) by 2005 through the application of duel fuel systems was approved in IEP5. Dual fuel systems are regarded by Eskom as medium-to-long-term solutions.
- *Self-generation displacement agreements.* This medium-to-long-term option entailed the displacement of 380 MW of load generated by municipalities in return for the temporary or permanent closure of their generation facilities.

Since IEP6, three additional strategic growth options have been identified. These include:

- commodity-linked pricing agreements;
- capital incentive programme;
- determined sales.

These strategic growth options are all currently being implemented.

5.1.2 Load shifting

Load shifting at Eskom is principally achieved through the application of time-of-use (TOU) tariffs, real time pricing (RTP), and geyser load management. A strategy to implement a long-term peak reduction target of 1 600 MW between 1996 and 2015 was approved by the Management Board in 1996 and included in IEP5 and IEP6. Table 1 gives a breakdown of these load shift-related energy savings.

Sector/programme	*Load shift (MW)*
Residential	
Centralised geyser control	400
General appliances (washing machines, pool pumps, heaters etc)	200
Commercial and industrial	
Heating, ventilation, air conditioning	250
Water heating	50
Process heating	100
Furnace load (melting/smelting)	600

Table 1: Breakdown of load shift savings
Source: Eskom IEP5/6

IEP7 assesses load shifting options of the following categories:

High and low capacity factor residential load shifting options. These include hot water load control, swimming pool pump programmes and co-ordinated control of existing municipal hot water load control resources. IEP7 recommends that Eskom should adopt a plan to implement 415 MW of high capacity load management in the residential sector. It also recommends that

all distributors be advised by Eskom to adopt the proposed low capacity residential load-shifting strategy in their best interest. Furthermore it recommends that Eskom should seriously consider setting up an energy services unit to facilitate this resource's delivery to the distribution business.

High and low capacity factor commercial load shifting options. Thermal/ice storage initiatives were included in the optimisation process for high capacity factors, and lighting controls, TOU supervision of commercial process loads (including amongst others restaurants, supermarkets, laundries and bakeries) and commercial water-heating load control for low capacity factor load shifting. IEP7 recommends that Eskom should monitor the uptake of ice storage systems in existing commercial buildings, and modify the shape of the forecast load if ice storage systems demonstrate a reasonable degree of market penetration. It is recommended that high capacity commercial load shifting should be further evaluated to determine competitiveness with power generation options. Depending on the outcome, Eskom might need to consider its pricing or financing strategy to reduce the negative revenue impacts on the bulk supplier and distributor. Regarding low capacity factor load shifting, IEP7 recommends that all options are further evaluated.

High and low capacity factor industrial load shifting options. In the case of high capacity factor load-shifting, the DSM option consists primarily of thermal storage on industrial process heating and storage of fluids on pumping systems. Ice storage of industrial HVAC systems was investigated, but found to be uneconomical. Low capacity factor load-shifting options primarily include controls on compressor systems, cooling systems, materials handling systems, process heating systems, and time of use supervision of electrical arc furnaces. IEP7 recommends that Eskom monitor the uptake of thermal and fluid storage systems in existing industrial plants. IEP7 recommends that high capacity industrial load shifting should be further evaluated to determine competitiveness with power generation options. Depending on the outcome of the evaluation, Eskom might need to consider its pricing or financing strategy to reduce the negative revenue impacts on the bulk supplier. Similarly to high capacity options, most of the low capacity factor DSM options in the industrial load-shifting categories are recommended by IEP7 for further investigation and possible inclusion in a future IEP.

Interestingly, of each of the high and low capacity factor load-shifting options, IEP7 recommends serious planning and implementation for DSM options in the residential sector only. These options are classified as 'green' options – either because they can compete with generation expansion options, or because they result in the avoidance of T&D costs that are higher than DSM implementation costs.

5.1.3 Interruptibility

IEP5/6 approved of a target of 3 200 MW of interruptibility by 2005. This is being achieved though negotiated contracts with customers including ALUSAF and the Ferrochrome Group, and the application of the interruptible tariff which was introduced in 1996. A breakdown of the IEP5/6 interruptibility target is given in Table 2 below:

Sector/programme	*Interruptible load (MW)*
Commercial and industrial	
Heating, ventilation, air conditioning	200
Pumping and compressor	300
Process heating	500
Furnace load (melting/smelting)	2200

Table 2: Breakdown of interruptible load savings
Source: Eskom (IEP6)

5.1.4 Energy efficiency

Because energy efficiency programmes improve the overall viability of participating customers and result in improved customer satisfaction levels, they are regarded by Eskom as important strategies for retaining customers and managing (potential) competition. A strategy to obtain a reduction in demand of 2500 MW by 2015 through the implementation of an energy efficiency programme was approved in IEP5. A breakdown of the 2 500 MW savings brought about through energy efficiency is shown in Table 3 below.

Sector/programme	*Energy efficiency (MW)*
Residential	
Hot water thermal efficiency	320
Efficient behaviour – info programmes	130
Efficient lighting	800
Ceiling insulation	250
Commercial and industrial	
Efficient lighting	330
Heating, ventilation, Air conditioning	290
Pumping and compressor	50
Water heating	50
Process heating	110
Materials handling	100

Table 3: Breakdown of energy efficiency savings
Source: Eskom IEP5/6

The programme is currently being phased over a fifteen-year period and, due to the significant contribution of households to the system peak demand, is set to focus primarily on the residential sector. IEP5 recommended that a further peak load reduction of 2 100 MW would be attainable (if required) though a more aggressive energy efficiency programme with a lead time of five years involving the use of solar electric thermal storage devices or advanced residential demand-side management techniques.

IEP7 assesses energy efficiency options of the following nature:

- *Residential energy efficiency options.* End-use targets for residential energy efficiency options to be included in IEP7 include: efficient lighting initiatives (781 MW), controlled system hotwater conservation (76 MW), cooking awareness (197 MW), energy efficient fridges/freezers (54 MW) and hot water system insulation (10 MW). Interestingly, of the 18 residential energy efficiency options that pass the total resource cost test, only two (118 MW through cooking awareness in new homes and 318 MW through modular CFLs in new homes) do not cause negative revenue impact. IEP 7 recommends that Eskom commit the necessary resources to implement this 1118 MW of residential energy efficiency in the next 20 years, as part of its official demand-side plan. IEP7 recommends that, in making every effort to ensure that revenue impact does not exceed avoided resource costs, Eskom may wish to move towards making electricity prices in the residential sector more reflective of the true cost of supply.

- *Commercial energy efficiency options.* Options evaluated by IEP7 include: process heating efficiency, HVAC system efficiency and lighting system efficiency. IEP7 recommends that Eskom continue to monitor the uptake of energy efficiency in existing commercial buildings. IEP7 recommends that commercial energy efficiency should be evaluated to determine if it competes with power generation options. IEP7 further recommends that, if commercial energy efficiency options are deemed viable, consideration must be given to the role that the resource should play as an alternative to network expansion in the distribution business. Finally, Eskom is advised to consider its pricing and financing strategy to reduce the negative revenue impacts on the bulk supplier and distributor.

- *Industrial energy efficiency options.* Options evaluated by IEP7 include process heating efficiency, HVAC system efficiency, lighting system efficiency, cooling system efficiency, fan system efficiency, compressor system efficiency, materials handling system efficiency, manufacturing process system efficiency and pumping process efficiency. IEP7 recommends that 686 MW of industrial energy efficiency options (including each of the above) should be evaluated to determine how and when it competes with power generation options.

5.2 Current DSM investments

Various of the DSM options identified in the IEP process as listed above have already been implemented. Other DSM options are currently in the pipeline (i.e. energy efficiency in residential market segment). This section gives a summary of DSM programmes currently being implemented, as well as those which are close to implementation.

5.2.1 Load shifting investments/initiatives

Examples of load-shifting investments that Eskom has made recently include the following:

- *COMRICON.* The COMRICON (Co-ordinated Municipal Ripple Control) initiative investigates technologies for optimising municipal ripple control sytems. Generally, this project entails Eskom Enterprises connecting highly specialised COMRICON equipment to established municipal ripple control systems. This system is then linked on-line to Eskom Enterprises Virtual Power Station. When municipalities are not operating their ripple control systems, the COMRICON comes into operation, making use of the load-shifting opportunities still remaining. The monetary savings resulting from these activities are then shared between the participating municipality and Eskom Enterprises. This project is currently being implemented in Kempton Park, Roodepoort and Durbanville. The project has already resulted in 100 MW of shiftable load. It costs R40/kW to implement (it is relatively inexpensive because most of the necessary infrastructure is in place). Recently, one of the municipalities participating in this process has asked Eskom Enterprises if they will take over the operation of the entire system (i.e. outsourcing management of municipal ripple control system as well as COMRICON). The arrangement that results from this will probably involve some form of performance contracting milestones.
- *FLEXICON.* This programme, which contributes towards Eskom Enterprises' Virtual Power Station (VPS), currently involves a pilot project, in Tableview, testing a state of the art hot water load control system. Currently, the project has resulted in shiftable load of 10 MW and costs R500/kW. Relative to other load-shifting initiatives this cost is high, because new investment in additional infrastructure was necessary. There are plans to extend this programme in Mabutu.
- *Real time pricing agreements.* In 1997, Eskom made available a dynamic tariff to some of its customers to (i) help Eskom under system constraints, and (ii) make surplus energy available to customers at cheap prices. Currently Eskom has real time pricing (RTP) agreements with four gold mines and one smelter. This has resulted in a shiftable load of approximately 150 MW to be integrated into the virtual power station. Eskom Enterprises hopes to improve the RTP system from a 24-hour to a one-hour ahead pricing system.
- *Time-of-use tariffs.* Eskom currently offers its end-use and redistributor customers TOU tariffs which seek to promote the more economic use of electricity in the economy. In the residential sector, Eskom is currently running a pilot project to test a residential TOU tariff – called Homeflex – in seven municipal sites (Durban, Kempton Park, Pretoria, Kimberley, Potchefstroom, Durbanville, and Kuilsrivier) and one Eskom site (Sandton). On gaining the co-operation of selected customers, research meters have been installed to their electricity supply points. The customer meter readings are then fed into a TOU Billing System. The aim of providing the customer with comparison bills is to illustrate the benefits of shifting load out of the peak demand period. While residential TOU tariffs are in their infancy, Eskom does offer important TOU tariff packages to its larger end-use and redistributor

customers. The NightSave tariff, for instance, targets customers with a notified maximum demand of at least 25 kW/kVA and who can move all or part of their electricity demand to Eskom's off peak periods. Similarly, the MegaFlex tariff is for large customers of 1 MVA and above who also have some flexibility to shift their load. Finally, the MiniFlex has been designed for customers with supplies of 100 kVA to 5 MVA.

5.2.2 Interruptibility agreements

Four categories of interruptible load have been identified within Eskom. They are:

- *Category I.* Customers who have agreed to form part of an interruptible load programme and with whom Eskom has a contract in place which allows for such interruptions.
- *Category II.* Customers who are prepared to enter into interruptible load agreements with Eskom based on the fact that their production processes are sufficiently flexible as to allow interruptions of limited duration.
- *Category III.* Customers who are prepared to enter into interruptible load agreements with Eskom due to their ability to generate a portion of their own electricity requirements if power supply from Eskom is interrupted.

Examples of Eskom's interruptibility investments in this area include the following:

- *Category 1.* Eskom's interruptibility DSM targets here are currently mainly being achieved through negotiated contracts with some of its largest customers. In this category, Eskom has negotiated agreements with ALUSAF and with the ferrochrome industry. Regarding ALUSAF, interruptibility at both the Hillside and Bayside plants is operational and effectively used by National Control. Compensation to ALUSAF for the interruptions has been included in the tariff offered and no post-compensation takes place. Interruptions must occur within the following constraints: (i) Eskom may not interrupt supply to a potline for more than 104 hours per calendar year; (ii) a maximum of two hours of interruption may occur within an 84-hour period; (iii) 84 hours must lapse after an accumulation of two hours of load interruptions.

  Eskom and the ferrochrome industry have entered into an agreement according to which Eskom will have the right to interrupt 50 per cent of the load used for ferrochrome production at the time of the interruption. At present production levels, the amount of interruptible load available is 370 MW. Ferrochrome producers are compensated for each interruption to their plant. The compensation amount is the reduction in energy consumed during the period of the interruption multiplied by the Miniflex energy rate(s) applicable during the time period. Table 4 below outlines the agreements currently in place and interruptible load associated with these agreements.

Source/agreements	*Interruptible load (MW)*
Aluminium	
ALUSAF (Bayside)	75
ALUSAF (Bayside)	75
ALUSAF (Bayside)	150
ALUSAF (Hilliside)	380
ALUSAF (Hillside)	380
Ferrochrome	
Consolidated Metallurgical Industries (Rustenberg)	30
Chrome Resources	45
Tubatse	78
Consolidated Metallurgical Industries (Lydenberg)	43
Ferrometals	81
Ferro Alloys	20
Middelburg Ferrochrome	40
Palmiet Ferrochrome	33
Additional ferrochrome load	50

Table 4: Contracted interruptible load
Source: Eskom (1995)

- *Category II.* It is expected that the majority of non-utility generation will be in operation during periods in which interruptible load is required. For this reason, no additional interruptibility based on non-Eskom generation is assumed without a significant amount of risk of non-availability.
- *Category III.* It is estimated that 1309 MW of interruptibility is available from customers with flexible production processes. This interruptibility potential is summarised in Table 5 below.

Organisation/industry	*Interruptible load (MW)*
Rand Carbide	50
Columbus	25
ISCOR (Pta)	50
HSV	22
Siltek	80
Metalloys	100
NCP	27
Cement industry	80
SAPPI (Ngodwane)	30
SAPPI (Springs)	74
Mondi (Richards Bay)	28
Mondi (Durban)	49
Carbochem	42
AECI	50
Gencor	64
Gold Fields	11
Anglo American	228
Anglo Vaal	31
Rand Mines	48
JCI	43

Organisation/industry	*Interruptible load (MW)*
Impala Platinum	50
Karee Platinum	5
Wesplats	20
Eastplats	4
Northam Plats	3
Rustenberg Plat (Rustenburg)	47
Rustenberg Plat (Union)	25
Rustenberg Plat (Amand)	17
PP (Rustenberg)	6

Table 5: Interruptible load obtainable from customers with flexible production processes
Source: Eskom (1995)

An example of a new interruptibility initiative in *Category III* is as follows: a number of years ago, Eskom initiated a programme which sought to add electrical boilers to existing heavy fuel oil boilers in a various different industries – in particular the textile and paper industries. The objective of this programme was to achieve additional electricity sales: customers previously using heavy oil fuels could switch to using electricity when it paid them to do so. Eskom sought to incentivise this switch by offering attractive tariff packages. In January 1999, Eskom implemented the LOSPREP (Load Shedding and Positioning Reporting) programme aiming to implement 'interruptible' technology to these steam customers' dual fuel boilers. Interestingly, until now, this interruptibility option has not been taken up by Eskom. Eskom Enterprises is now taking up on this opportunity. The programme currently targets 40 000 geysers in six different sites in Durban and Cape Town and at a cost of R5/kW. To date, R200 000 has been spent on LOSPREP activities. It is believed that this initiative currently has the potential to shed load of up to 40 MW.

5.2.3 Energy efficiency and education initiatives

As indicated in the section on IEP planning processes, most of Eskom's energy-efficiency-type DSM initiatives are currently being targeted at the residential sector. One of the reasons for this is that this sector contributes significantly towards Eskom's peak demand. Another reason for this is that, currently, there are opportunities associated with the residential sector – in particular the low-income sector – which are likely not to be available in a few years' time (for example, electrification and housing programmes, and global environmental mechanisms). With a focus on residential initiatives, the following outlines current Eskom investments in this area:

- *ElektroWise campaign*. Launched in 1992, the ElektroWise campaign is a branded free advisory information service from Eskom which seeks:
  - to inform, advise and educate customers on the safe and efficient usage of appliances, as well as home and public safety;
  - to reduce current energy loss levels;
  - to ensure customer service levels reach and exceed targets of 8 for MaxiCare, and PreCare;
  - through energy management, to influence load by establishing DSM interventions;
  - to improve on current levels of brand awareness among the different sectors;
  - to positively influence consumption levels of newly electrified customers;
  - through sponsorship, to assist in the development of athletic skills and talent at school level;
  - to actively endeavour, through ElektroWise initiatives to improve the bottom-line contribution to Eskom's business.

  Eskom's *vision* is to position ElektroWise as a highly visible professional marketing service provider satisfying the electricity service needs of all residential customers. Its *mission* is to

provide innovative, practical and top quality products and services which will improve the quality of life of customers in the residential market and contribute towards the social, technical and economic upliftment of communities in South Africa. Eskom has trained a specialist force of over 400 Elektrowise Sales Advisors whose prime task is to educate and advise customers on all aspects of electricity – from safety and convenience considerations through to ways of economising on energy consumption, choosing the right appliance and so on. These advisors interface with customers on a one-to-one basis either in the home or at one of Eskom's Customer Advisory Centres.

- *Schools Programme.* Eskom has developed a kit (which includes a manual, worksheets with exercises, a watt-log meter, a CFL and some insulation) which is targetted at educating Standard Four pupils about energy efficiency related issues. This programme has been launched in five pilot schools in the Western Cape. Even though this programme is costly to Eskom, it is likely that it will be extended in the year 2000.
- *Efficient Lighting Initiative (ELI).* Recently Eskom, the International Finance Corporation (IFC) and the Global Environmental Facility (GEF) agreed to work together to establish a cost-effective, robust market for energy-efficient lighting in South Africa. The Efficient Lighting Iniative (ELI) will seek to introduce appropriate lighting and luminaires into the low-income, disadvantaged communities that are currently being electrified at a rate of over 300 000 homes per year; 'normal' existing and new household markets with multiple light points per dwelling, including low-, middle-, and high-income households; and commercial and institutional building markets and industrial plants. A business plan for the ELI has been designed, and Eskom has committed funds to this project. In line with Eskom's agreement with the IFC and GEF, the initiative will be carried out by an implementing agency partly owned by Eskom.
- *Sustainable Homes Initiative.* Funded by the British government, the International Institute for Energy Conservation (IIEC) and Eskom are currently jointly undertaking a project to undertake to enhance the thermal efficiency of South African homes (in particular, low income homes).
- *Ceiling commercialisation.* Eskom has a stake in the recent development of a ceiling which is said to cost about 20 per cent of what it normally costs to buy and install a commercially available alternative. Clearly, this low-cost product goes a long way in reducing or even removing the affordability barrier currently inhibiting improved thermal efficiency in low-income households. Eskom plans to commercialise this ceiling.
- *Commercial DSM.* In the recent past, Eskom made a decision to make their headquarters, Megawatt Park, more energy- and water-efficient, as well as to educate Eskom employees on energy and water efficiency. This has been achieved through the installation of energy-efficient lighting and variable speed drives in the building. An energy audit was also undertaken. Eskom is also in the process of converting from the standard rate tariff to the Megaflext tariff which will result in a further decrease in the energy bill associated with Megawatt Park. Eskom Enterprises plans to undertake a similar initiative at the University of Pretoria. The latter will contribute 3MW at a cost of R100/kW to Eskom Enterprises Virtual Power Station (VPS). ElektroServe is currently providing energy service products to the hotel, tourism and health industries to enhance building energy efficiencies. To date, ElektroServe has provided audit services to a number of hospitals, hotels and game lodges, and advice on areas where energy waste can be reduced. For the most part, this service has then lead to the development of a sustainable energy management strategy for the institution (covering issues like staff training, DSM initiatives, technological improvements, monitoring, environmental linkages, etc). Most of this consulting work has been carried out by ElektroServe for a set fee; party because of the potential impacts energy efficiency has on Eskom's bottom line, an overall CDSM strategy for Eskom has not been formulated, so few performance contracting arrangements have materialised. Finally, ElekroServe has been involved in replacing coals-fired boilers, used by hospitals and prisons to generate steam, with dedicated electric appliances.

5.3 Barriers inhibiting Eskom investment in DSM

Key barriers inhibiting Eskom from investing in DSM are listed below. Note that in general most of these individual barriers are not influential enough to prevent DSM from occurring: rather, they make it more difficult for DSM to be implemented.

5.3.1 It is possible that current DSM investments may become stranded

Many utilities around the world have felt threatened by pending electricity industry restructuring. On a broad level, the concern has been that restructuring would bring about an era of uncertain rules and levels competition. Utilities have been responding to this threat by cutting all expenses deemed to be 'non-essential'. These cutbacks include long-term research and development programmes, services to low-income customers, cost-effective renewable energy acquisition programmes, as well as utility DSM programmes.[7] Specifically, confidence in DSM has been undermined by the propositions that increased competition could:

drive utilities to concentrate on lower prices rather than on lowering the overall cost of electricity services. Energy efficiency seems to be at cross-purposes with utilities' efforts to prepare for cut-throat competition by cutting commodity prices;

increase the potential of utilities being left with current grid networks and running costs spread over a lower customer base has undermined confidence in DSM investment. Utilities are determined not to incur more stranded costs at a time when tens of billions are already at risk;

make it unclear who is responsible for DSM.

In South Africa, the electricity industry is soon to be restructured. The threat of restructuring has affected Eskom staff and operations in mixed ways. Some in Eskom do not appear to consider restructuring to be a significant threat to daily activities and organisational structures; others find it difficult to picture the new electricity industry. In consequence, both groups continue to operate on a 'business-as-usual' basis. The perspectives of the majority, however, follow those of their international counterparts: because restructuring will bring about far-reaching industry changes it is seen as being important to act 'cautiously' until the 'rules and nature of the game' have been established. In line with this view, DSM is viewed by some as a non-essential service that contradicts Eskom's business objectives, and should therefore not necessarily play a role in the emerging context. Others argue that DSM will be taken up by the market where the needs arise.[8] A middle-of-the-road approach, and one that Eskom is now attempting to follow, is that DSM programmes should at least pass the total resource cost (TRC) test (and preferably also the Utility Cost (UC) test and/or the ratepayer impact (RIM) test) to qualify for programme implementation. It is suspected that. in future, Eskom's IEP decisions will be increasingly based on bottom-line impact and that the TRC test will be replaced by utility-centric measures such as the utility cost test.

5.3.2 It is unclear that Eskom (and other utilities) should continue to house energy-efficiency DSM programmes

International experience also indicates that, as restructuring processes get underway, the rationale or justification for utilities housing DSM (in particular of the energy efficiency type) diminishes. Previously vertically integrated, publicly-owned utilities have been thrust into contexts in which low electricity prices are of paramount importance, and where it no longer makes sense for them to administer public money for public-purpose DSM programmes. In Eskom, the DSM programmes are housed in the Marketing Division, which in turn is housed in Eskom Distribution. On the one hand, this positioning makes sense, as Distribution is closest to municipalities and to customers. It has also been argued that, because Eskom is owned by

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7 Some international utilities have sought to reduce the inevitable tariff impact of DSM programmes by lowering energy savings targets and placing more emphasis on benefit/cost tests to measure rate impacts as opposed to a reduction in overall costs. In other words, some utilities have shifted their criteria for acceptable DSM programmes from passing the TRC test to the RIM test.

8 In many countries market-driven DSM has not materialised, and some argue that this indicates that DSM was not needed in the first place.

government, it should accept some responsibility for the delivery of public goods (such as energy efficiency). It also does not seem clear that Eskom should make profits based on the wastage of its customers. On the other hand however, the Distribution Group's objective is to increase sales. Indeed, the substantial differential between the cost and selling price of electricity means that every kWh not sold is ultimately meaningful. Thus, for Distribution Group, energy-efficiency DSM should logically be placed on the backburner. For some time, debates have been raging in Eskom as to whether, in the coming context, this organisational structure still makes sense. This debate has, at times, created much internal uncertainty, which again has not helped to fortify DSM programme activities and staff.

5.3.3 There may be tensions between Eskom's short-term objectives, and the industry's longer-term objectives

Uncertainty regarding the future structure of the electricity industry has also resulted in Eskom staff becoming less sure about how far to promote DSM (in particular energy-efficiency DSM programmes). For example, industrial energy-efficiency DSM generally entails investment in longer-term options (for example, dual fuel options). Numerous Eskom staff have expressed a concern that they may be currently advising customers to switch to new technologies and/or processes that customers could later be disadvantaged by, or even penalised for. If, for example, the NER allows IPPs to participate in the electricity market, and if ensuing wholesale competition puts downward pressure on electricity prices, then perhaps dual fuel technologies installed now may become stranded investments.

5.3.4 The nature of the future regulatory regime is uncertain

In general, Eskom does not work in a policy vacuum. This is to say that Eskom's decisions are usually made very much in keeping with current requirements of and developments in the electricity industry as well as in keeping with government's national development plans. For example, in the White Paper on Energy Policy it is stated that:

> The Department of Minerals and Energy will ensure that an integrated resource planning approach is adopted for large investment decisions by energy suppliers and service providers, in terms of which comprehensive evaluations of the economic, social and environmental implications of all feasible supply and demand-side investments will have to be undertaken. In the electricity sector's case, the National Electricity Regulator will only license new facilities upon the satisfactory completion of an integrated resource plan.

Eskom's response to this particular policy statement was to markedly increase the budget set aside for in-house IEP activity. Eskom has also been keen to participate in the IRP debates initiated recently by the NER. It has been speculated that, if this policy were not in place, Eskom may have been more likely (in the context of pending electricity industry restructuring) to downscale (rather than upscale) its IEP activities.

Recently, Eskom expressed a concern that they 'do not have enough information' about the national policy arena to be able to make well-informed decisions. Some Eskom staff have rejected the notion that a National Integrated Energy Plan should be informed by sectoral integrated energy plans. This bottom-up approach is illustrated in Figure 3.

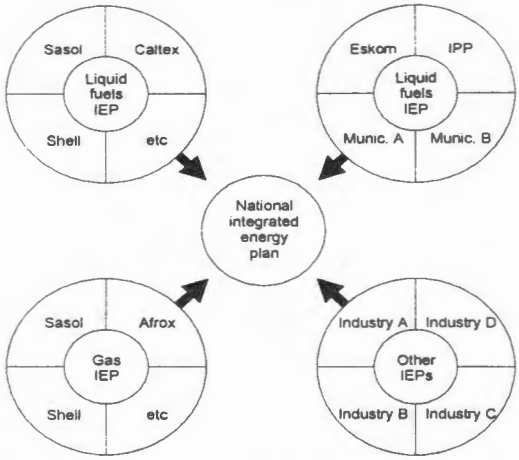

Figure 3: Bottom-up national energy planning approach
Source: Lennon (1999)

Instead, a top-down planning approach is called for (see Figure 4 below). According to this approach, South African national policy (including macroeconomic, energy and environmental policy) is key to the development of the Department of Mineral and Energy's integrated energy plan. Similarly, the NER's national IEP is shaped by government policy and national IEP. Eskom argues that it (and municipalities) can only develop integrated electricity plans if information about, and guidance on, the policy and plans of government and the NER are forthcoming. Currently some Eskom staff argue that this information – especially that related to the NER – is currently unavailable (or unclear?) and that this is slowing down Eskom's internal IEP processes and hence programme implementation. For example, earlier this year, a group of Eskom staff working on the efficient lighting initiative approached the NER with a suggestion of how the cost of the DSM programme could be recouped. They inquired if the NER would allow a small levy on tariffs so as to incentivise Distribution to undertake this initiative. The NER's response was that it was unable to allow this levy for single projects but instead was looking for an industry-wide solution to the delivery of public goods benefits such as was being proposed by the ELI. The NER is yet to set the stage (or even delivery clarity) on funding energy-efficiency programmes such as the ELI.

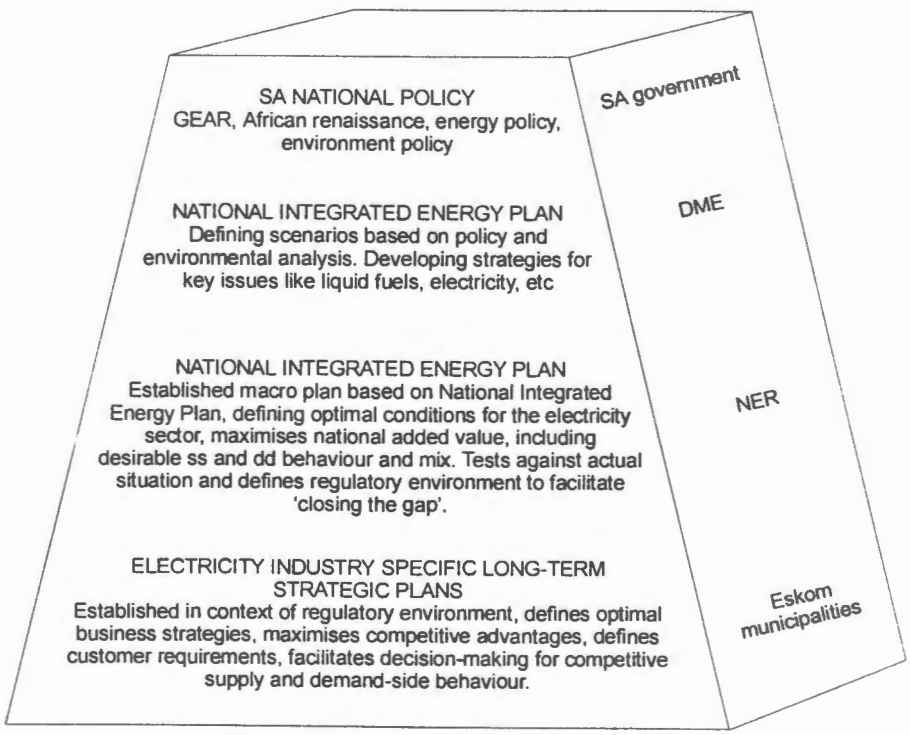

Figure 4: Top-down planning approach
Source: Lennon (1999)

5.3.5 Eskom's key performance indicators (KPIs) do not reward DSM

Eskom measures its progress in terms of a set of key performance indicators. These KPIs are used to measure performance against budget and are reported to the Electricity Council and the Management Board on a monthly basis in the Eskom and Group business reports. *Eskom's objectives and associated KPIs are communicated to, and measured at, all relevant staff levels.* KPIs for 1998/9 are listed in Table 6 below.

Objectives	*Key performance indicators*	*Performance results*
Reducing the real price of electricity. Reduce the real price of electricity by 15% by the end of 2000	Cumulative difference between the Eskom annual price increases and the average consumer price indices since 1 January 1999	Targets met to date
Electrification. Electrify 1 750 000 homes by 2000	Number of homes electrified since 1 January 1994	Targets met to date
Implementing employment equity. Change the staff profile so that 50% of management, professional and supervisory staff shall be black South Africans by the end of the year 2000	Black management professional and supervisory staff at 31 December 1998 (%)	Targets met to date
Human resource management. Educate, train and upgrade sufficient people to meet future managerial, technical and other professional staff needs, *inter alia* by: • having on average 370 black trainees and bursars to complete their training annually • enabling all Eskom employees to become literate.	• Managing and retaining intellectual capital • Black bursars and trainees completed training (number) • ABET learner days (number) • Overall pass rate (%)	Good progress made Target exceeded Good progress made Good progress made
Transparency and worker consultation. Maintain transparency and worker consultation in decision-making	Forums and processes to facilitate worker consultation in decision-making	Progress made, notwithstanding setbacks experienced during 1998
Community development. Contribute R50 million per annum to the electrification of schools and clinics and other community development activities	Annual contribution (Rm)	Achieved
Employees access to accommodation. Enabling all employees to own a home.	Eskom policy on home loans and rental subsidies in place	Facility provided
Black economic empowerment. Encourage small and medium enterprise development	Procurement expenditure on black economic empowerment (Rm)	Target provided
Limited environmental impact. Protecting the environment.	Indicators including, *inter alia*, the following: • Environmental contraventions (number) • Relative water consumption (l/ kWh) • Particulate emissions (kg/MWh sent out) • Radiation exposure (mSv)	 Contraventions reduced Achieved Achieved Achieved
Maintain financial independence. Financing the above from South African and own resources, and from overseas development funding	Maintain financial independence by accessing resources without recourse to government	Achieved
Technical performance. Excellent technical performance.	• Sustainability index consisting of 24 measures (%)	Achieved 75.4% against a target of 80%. Highlighted as a focus area for improvement in 1999

Objectives	*Key performance indicators*	*Performance results*
	• Safety - Disabling injury incidence rate (number) - Fatalities (number)	Remains an area of concern
	• Generation plant performance, - Unit capability factor (%) - Unplanned automatic grid separations (number)	Target exceeded
	• Transmission plant performance	Achieved
	• System minutes lost with severity greater than one minute, (number)	Achieved
	• System interruptions (minutes)	Achieved
	• Distribution system performance/ System average interruption duration and average interruption frequency indices	Adversely impacted by weather. Highlighted as focus area for improvement in 1999
	• Customer satisfaction levels, PreCare and MaxiCare indicator	Achieved
Financial performance.		
Operating and capital resources are used economically, efficiently and effectively	• Productivity improvement for the year (Rm)	Adversely impacted by negatives sales growth
	• Total electricity cost (c/kWh)	Achieved
Maintain financial viability over the long term	• Employees (number)	Achieved by reducing employee numbers
	• Net profit for the year (Rm)	Negatively impacted by low sales growth and weak commodity prices
	• Debt-equity ratio	Targets met to date by reducing debt-equity ratio

Table 6: Eskom's key performance indicators
Source: Eskom (1998)

While a number of Eskom's corporate objectives (e.g. limiting environmental impact) and KPIs (customer satisfaction levels, 'PreCare' and 'MaxiCare' indicators) may *indirectly* have some impact on DSM performance, they do not appear to *directly* reward staff or programme performance in DSM-related activity). Interestingly too, the only customer satisfaction KPI (as noted above) is categorised within 'technical performance' objectives, and not as a KPI that extends beyond technical excellence towards a broader set of measures describing Eskom's overall customer service performance.

In addition to not providing any performance incentives for DSM, some of these objectives and KPIs disincentivise investment in DSM. As long, for example, that it remains a corporate objective to 'reduce the real price of electricity', there will always be a bias against investment and performance in DSM-related areas. Eskom's foremostly important financial performance objectives and associated KPIs also discourage DSM. The principal KPI in this area (i.e. 'the Rand value of productivity improvement[9] for the year') is driven by electricity sales volumes.[10]

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[9] Productivity statements provide key insights into business performance by analysing the change in net profit between accounting periods in terms of the impact of productivity, inflation (price recovery) and growth.

[10] It is noted in Eskom's annual report (1998) that the main reason for the negative productivity performance in 1998 was a decrease in electricity sales during the year compared with the 1997. It is also interesting to note that the prevailing sentiment at Eskom does *not* appear to be that if efficiency improvements are

Indeed, this year, Eskom's top priority is to increase electricity sales. As Distribution (especially Marketing) urgently develops strategies to increase kWh sales, as well as takes responsibility for most of Eskom's DSM activities, the prospects for DSM seem somewhat bleak.

5.3.6 The broader economic context does not currently encourage investment in DSM

Eskom's electricity sales were lower in 1998 than in 1997 even though its customer base had grown quite significantly (see Table 7 below).

	1998	*1997*	*Change 1997-1998*
Number of customers	2 563 656	2 244 407	14.2
Sales (GWh)	171 454	172 550	(0.6)

Table 7: Eskom customers and sales statistics
Source: Eskom (1998b)

This decline in sales volume has been attributed to changing usage patterns associated with unseasonal climatic conditions (warm winters, and good rain). Reduced electricity sales are have also been linked to reduced energy demand associated with the poor performance of the South African economy in the last couple of years. The low energy demand experienced during 1998 also led to an increase in the system operating reserve margin from 16% in 1997 to 22% in 1998. In view of this, it has been suggested that the installation of new capacity (or the re-commissioning of mothballed plants) may take place later than previously anticipated (Eskom 1998a). Clearly, this context does not bode well for current investment in DSM.

In the light of this context, it is interesting to note that Eskom has not chosen to abandon its DSM efforts. As noted as per IEP recommendations (in section 5.1 above), DSM options are still on the table. They, like all potential future investments at Eskom, are just being cautiously scrutinised.

5.3.7 It does not always pay Distribution to undertake DSM programmes

Generally, where a utility is vertically integrated there is more scope for, and better acceptance of, DSM than when the utility is unbundled – because DSM then makes more sense: distribution has the closest contact with the utilities' customers (DSM is customer-oriented) and so undertakes to execute DSM programmes. Generation is willing to pay for the costs associated with DSM because it often pays to defer investment in new installed capacity. Transmission may also pay for DSM if the need to upgrade transmission networks can be deferred.

Interestingly, when Eskom operated as a true vertically integrated utility (even before business units were ringfenced) its investment in DSM was minimal. This can be attributed to a number of different barriers, including the excess in installed capacity. With ringfencing, and the need to focus on business unit planning, budgeting and profitability, the Distribution Group has struggled to justify investment in DSM. In line with international trends, countless internal and independent assessments have shown that DSM programmes tend to have a negative revenue impact for the distributing utility. This applies to Eskom's Distribution Group. In fact, Eskom Distribution appears now to have less incentive to undertake DSM than do municipal distributors. This is because tariff structures currently provide incentives for municipal distributors to undertake DSM. Eskom's Distribution Group, on the other hand, does not receive these same incentives when buying power from Eskom's internal pool at internal price mechanisms.

For the most part, the Distribution Group has taken responsibility in the past for the payment and implementation of DSM programmes. It has not always volunteered to do this – most

made, profit margins will improve and business growth will be achieved. Rather, it is that sales growth in the short term is the key to profitability.

times, it has done so because of directives from management. Until recently, Generation has not contributed to the costs associated with DSM programmes. Generation's argument for not paying for DSM is that the group is too far removed from customers. In addition, Generation argues that the Wholesale Electricity Tariff (WET) will provide an incentive for distributors to undertake DSM where it is economically viable to do so. It is unclear who will pay for DSM in the future. If Distribution is unable or unwilling to do so, and Generation does not either, investment in DSM in Eskom may become an endangered species.

5.3.8 A conflict between short- and longer-term revenue DSM impacts hinders optimal investment

The need to ensure that Eskom continues to operate as a sustainable business in the present challenging environment has made it necessary, over the last few years, for Eskom to be repositioned. In this respect, the NER has required (for licensing purposes) that Eskom Generation, Transmission and Distribution operate as separate business units. From July 2000, Eskom will operate as a company liable for income tax and dividends. Ringfencing and corporatisation has compelled Eskom's business units to focus on bottom-line profitability. This has impacted on the way DSM investment decisions are made. As noted previously, decisions are increasingly being made based on utility-centric decision criteria rather than on the total resource costs and benefits of the particular investment (i.e. its full costs and benefits to society as a whole). Until recently, DSM investment decisions also tended to be based on *short-term* bottom line impacts rather than longer-term ones, notwithstanding that fact that the very nature of DSM lies in the achievement of significant national benefits accrued over the *lifetime* of the investment.

Because of the way decisions about investment in DSM have been made in Eskom, many DSM programmes – some which have been shown to offer significant national benefits over the lifetime of the investment, as well as positive revenue impacts for Eskom in the medium term – have been rejected by the IEP optimisation process. It is unclear whether this barrier to investment in DSM will persist. Some argue that, because of newly introduced improved IEP accounting methods which allow for a better treatment of post implementation costs and benefits, DSM is likely to fare better in the optimisation process. Others concur with this view, noting that in the future it is likely that, as environmental performance requirements and standards become stricter, support for DSM investment will grow (i.e. that it is deemed better to invest in DSM than re-introduce mothballed coal-fired plants).

In sum: the approach Eskom adopts to make decisions about DSM investments prejudices its adoption. This is because:

- decisions are moving away from TRC (i.e. including national benefits) to ones that only include impacts on the utility;
- decisions are based on short-term impacts rather than long term impacts of DSM interventions;
- full (or life cycle) costs and benefits associated with DSM interventions are not being accounted for.

5.3.9 Within Eskom, there is a lack of confidence about DSM

While there is no scientific basis for this, it was frequently heard in the interviews conducted to establish DSM barriers that there is a concerning lack of confidence in the impact that DSM can actually (rather than theoretically) make. Comments such as: 'DSM is relatively new – its establishment has been hard in a utility that is dominated by supply-side specialists.' *Note that all comments in quotation marks (in this section) are those from interviews.*

'DSM has never had a chance to prove itself in Eskom'. It has been noted that this is because:

There is excess capacity – i.e. 'DSM as an alternative hasn't come into its own yet because South Africa has not yet has to look into different options'.

DSM projects have all been relatively small. It is difficult to 'seriously compare these projects with power stations'. Also, 'small projects only tend to make small impacts'.

'There has been very little DSM implementation experience. Without implementation experience it is impossible to verify actual costs'.

There has been very little governmental leadership and support in this area.

Clearly, this lack of confidence in DSM does not bode well for it.

5.3.10 Highly specialised skills are in short supply

There are few people in Eskom who have the necessary technical skills to take on and operate the IEP optimisation process. While there is no evidence to suggest that this process is currently threatened by a shortage of skills in this area, Eskom staff have expressed a concern that this may not always be the case.

5.3.11 Links in the supply chain to deliver DSM are not yet in place

The energy efficiency service industry is South Africa is in its infancy. Unlike other countries – in particular, the United States – there are not yet many energy service companies (ESCOs) in existence, local service providers do not prioritise energy efficiency services, financing houses are not accustomed to the financing needs of energy efficiency and so on. Essentially, the energy service industry has no 'critical mass'.

Eskom has become the lead and co-ordinating player in this area. This is a challenging task to say the least. It could even be argued that when Eskom's management gives the go-ahead for the implementation of a DSM programme, it is just the beginning of the road. As current experience with the Efficient Lighting Initiative has shown, if Eskom plans to implement a DSM programme on a large scale, it has to create the entire environment for it. Often, it has to convince financing houses that energy efficiency is a worthwhile investment, procure and test the technologies required, bring together retailers, distributors and manufacturers, convince municipalities that energy efficiency is worthwhile, co-ordinate international funding opportunities, sometimes design the technology requirements, create energy service companies to implement the programme, be the provider of public goods, and so on. When DSM is not even a priority in Eskom, it is commendable that the DSM team has made as much progress as it has.

The sentiment of many in Eskom is that this challenge is not only sometimes too great for the relatively small DSM team to handle, but that it is also not their role to play in the first place (see section 5.3.2 above). In this regard, it is interesting to note what is currently happening in Eskom. DSM activities are being taken out of regulated Eskom, and housed instead in Eskom Enterprises or an associated implementing agency. Two current examples of this are as follows: (i) Comricon, Flexicon, Losprep are currently housed in Eskom Enterprises' Utiliserve (under the Virtual Utility concept); and (ii) the ELI programme implementation is now classified as an ESCO activity and is set to be transferred to an implementing agency partially owned by Eskom Enterprises. Notwithstanding these new developments, it should be noted that it is a barrier to the implementation of Eskom-initiated DSM that the energy service industry is currently unable to support (and add value to) such initiatives.

5.3.12 Eskom has limited direct control over customer facilities

Customers prefer not to hand over the control of their facilities to utilities, whether for heating of homes, airconditioning in commercial buildings, or for the cooling processes in the mining sector. They prefer to be able to respond accordingly to price signals given to them by Eskom or other distributors. It is a barrier to DSM at Eskom that this is the case. Very often Eskom cannot rely on the efficacy of price signals because of other barriers faced by customers, or because customers feel that they cannot trust Eskom or other distributor to handle the process well. That this is done well is particularly important for industrial customers.

5.3.13 'New' regional competition for DSM is rapidly emerging

With the opening up of the region and the establishment of the Southern African Power Pool (SAPP), it has been argued that DSM options have to compete not only with South African generation options but also with other southern African supply options – including hydropower

and gas reserves. Thus, while IEP7 brings about a more favourable environment for the consideration of DSM options, new regional supply options reduce DSM potentials.

6. Government energy-efficiency initiatives

Many countries chose to create an enabling environment for energy efficiency in three different ways. Utilities and energy service companies take responsibility for implementing efficiency initiatives (such as installing efficient equipment into commercial buildings and introducing compact fluorescent lamps into the residential sector). Regulatory authorities develop frameworks according to which utilities and other roleplayers in the electric sector are obliged to operate. For licensing purposes, for example, regulators may require utilities to base investment decisions on the principles of IRP and/or allow utilities to recover the costs of DSM programmes in tariff increases. Government's role, traditionally, has been in the development and enforcement of legislation, including energy-efficiency codes and standards. In this section, a brief discussion of recent past and present energy efficiency activities of the government and NER are given; it will become apparent that the government and NER are seeking to operate in a similar manner to other countries.

6.1 Current energy-efficiency initiatives

The South African government's recent undertakings vis-à-vis energy efficiency include the following:

- *White Paper on Energy Policy.* In December 1998, the Minister of Minerals and Energy released South Africa's White Paper on Energy Policy. The White Paper notes that : '[s]ince expenditure on energy constitutes a large proportion of the country's GDP (15%) and a particularly large proportion of poor household's expenditure, it is necessary to give attention to the effective and efficient use of energy. Energy efficiency and energy conservation considerations must therefore form part of an overall energy policy.' A section of this document is dedicated to energy efficiency in industry and commerce, households, transport and government. In addition, the White Paper commits the government to ensuring that an IRP approach for large investment decisions by energy suppliers and service providers is undertaken.
- *National Energy Efficiency Agency.* The Department of Minerals and Energy is in the process of determining the feasibility of establishing a national Energy Efficiency Agency, which would provide an implementation vehicle for current DSM and other institutions' energy efficiency-related activities, including:
  - developing a strategic framework for energy and thermal efficiency in South Africa;
  - assisting the DSM and Eskom in bringing stakeholders together into constructive debate on energy and thermal efficiency issues;
  - seeking funding for project development, pilot projects and so forth;
  - lobbying DoH and DoE to formulate policy;
  - expanding the Enerwise programme to include low-income households;
  - supporting research and development in energy and thermal efficiency;
  - developing and disseminating information materials on energy and thermal efficiency (Simmonds & Clark 1998);
  - supporting the NER, where appropriate.

  To date, a draft business plan has been delivered by consultants commissioned to investigate this issue. Due to new DME priorities and resource constraints, this initiative has not been carried further forward. It has been suggested that a second, more in-depth study on the feasibility of such an agency be commissioned.

- *Thermal efficiency initiatives.* The White Paper states that government is committed to establishing energy efficiency norms and standards for commercial buildings, as well as voluntary guidelines for the thermal performance of low-cost housing. To this end:
  - The South African Energy and Demand Efficiency Standard (SAEDES), which addresses energy efficiency in commercial buildings, and is in final draft form, is soon to be handed over to the South African Bureau of Standards (SABS) for testing. It is expected that this standard will soon become mandatory for the commercial buildings industry in South Africa.
  - The DME has teamed up with the Council for Scientific Industrial Research (CSIR), International Institute for Energy Conservation (IIEC) and others to develop a programme for South Africa similar to the Energy Star Buildings in the United States and United Kingdom.
  - The 'Environmentally Sound Low-Cost Housing Task Team', an interdepartmental committee with membership from the Departments of Housing, Health, Water Affairs and Forestry, and Environment and Tourism, has recently completed a discussion document on guidelines/recommendations for energy efficiency, water efficiency and urban greening. This document is being used as an information tool. The Task Team has also contributed to a Minimum Norms and Standards document on low-cost housing Lewis 1999).
- *Appliance labelling initiatives.* The White Paper on Energy Policy commits the government to establishing an appliance-labelling programme. To date, a proposal to develop a project on this has been written and introduced to the Energy Branch, and then to the 'Household and Electrical Products Division' of the Department of Trade and Industry. It is likely, though, that the DTI will choose to rely on market transformation initiatives undertaken in the international arena to bring about improvements in South Africa.
- *Educational initiatives.* The National Domestic Energy Efficiency Task Team has completed its recommendations for efficient use of energy in households. Local authorities will be able to promote energy efficiency in their areas of jurisdiction by using the recommendations to persuade users to use energy more efficiently.

  The government also proposes to include energy and energy efficiency issues in school curricula at all levels. Information materials have been developed to be used as reference material for the Technology 2005 project that was initiated by the Department of Education. This material has been developed to meet the set of requirements for the outcomes-based education system that has been introduced by the Department of Education. Ongoing consultation, at various levels, has been proceeding in order to facilitate the acceptance of the material.

On the regulatory level, the NER was established in 1995 as the regulatory authority over the electricity supply industry. Its mandate is to protect the interests of electricity customers from the monopoly power of their suppliers and to ensure that the industry and all its components operate efficiently. Until recently, the NER has chosen to adopt a 'light-handed' regulatory approach. It is likely that this will change as electricity industry restructuring takes hold. It has recently been suggested that, in the future, the NER will require, as part of licensing agreements, that investment decisions at generation, transmission and distribution levels be based on IRP principles. The NER has suggested, furthermore, that it will not wait until the electricity distribution industry is rationalised before it introduces this additional licensing requirement.

6.2 Barriers inhibiting investment in energy efficiency initiatives at government level

6.2.1 The DME's organisational structure does not support energy efficiency

Recently, the Energy Branch of the Department of Minerals and Energy was re-organised. Table 8 below illustrates the latest organisational structure of the Energy Branch.

Chief directorate[11]	*Directorates/ (sub-directorates)*
Electricity	Electrification/ (grid and non-grid) EDI restructuring and electricity policy/ restructuring and electricity policy)
Hydrocarbons	Liquid fuels Coal and Gas and the Environment
Nuclear and Renewables	Nuclear Renewables

Table 8: Focal areas of the Energy Branch
Source: Surridge (1999)

In this new structure, energy efficiency, together with black economic empowerment, capacity building, and education are regarded as 'cross-cutting' energy issues. There is no longer a line function (or an 'office') for energy efficiency issues, as there used to be in previous organisational structures. Senior staff of the Energy Branch remain adamant that this organisational structure should not be taken to indicate that energy efficiency is no longer a priority of government. To the contrary, energy efficiency in the domestic sector is said to remain key. While energy efficiency does, indeed, concern all aspects of energy, it has also been argued that since there is no longer a dedicated line function (and associated personnel and other resources) for energy efficiency, it is in grave danger of petering out. This argument holds true if seen in the context of value added in this area since the Energy Branch was restructured last year.

There is no doubt that the Energy Branch is aware of this 'gap' – indeed, a tender was recently awarded to an external energy consultant to build, amongst other things, government's capacity in IRP. It is too soon to determine if this year-long project will make a difference. In the meantime, it is held that the organisational structure of the Energy Branch of the Department of Minerals and Energy is a barrier inhibiting government initiative in the area of energy efficiency. In fact, currently, it is unclear that the government has the 'appropriate institutional structure and capacity for the implementation of energy efficiency strategies' as was committed to in the White Paper on Energy Policy.

6.2.2 Resource constraints limit the priority list of government

In May 1999, the staff complement of the Energy Branch of the Department of Minerals and Energy was 48 (including support and administrative personnel). Current priorities in the Energy Branch include:

- restructuring of the electricity supply industry;
- electrification;
- restructuring of the liquid fuels industry;
- new gas pipeline development opportunities;
- new legislation (Nuclear Bills, Energy Bill, Gas Bill).

Given the largeness of these issues, and the associated attention that they will undoubtedly require, it is unlikely from a human resource point of view that energy efficiency will receive adequate attention in the foreseeable future. This is clearly a barrier inhibiting government from creating an enabling environment for energy efficiency.

Budgetary constraints also severely limit the attention that staff of the Energy Branch and other governmental departments can devote to energy efficiency. Governmental departments, for example, have not allocated any funds to the Environmentally Sound Low-Cost Housing Task

[11] Chief Directors are responsible for the cross-cutting issues of black economic empowerment; capacity building; health, safety and the environment; and energy efficiency.

Team. Thus, even if members of this interdepartmental committee do have time to dedicate to thermal efficiency issues, they are financially limited. Another example of this relates to the proposed establishment of the Energy Efficiency Agency: senior staff of the Energy Branch have stated that government will probably not be in a position to fund this agency and that external funding would need to be secured.

6.2.3 'Twice bitten, thrice shy'

In the fairly recent past, the Energy Branch has established two 'independent' agencies: Renewable Energy Fund for South Africa (REFSA) and the NER. Since then REFSA has been closed down, and some of its staff recalled to the DME. Senior NER management were recently dismissed, on the grounds of serious financial mismanagement. It is suspected that the government is now wary of establishing a new 'independent' government agency. Its experiences of doing so in the past have been fraught with difficulties.

6.2.4 Light-handed regulatory approach which is still to require DSM performance

Until now, the NER has not required that Eskom and local authorities undertake any investment in DSM or base investment decisions on IRP principles. As noted, the Regulator has suggested that in future it will require utilities to undertake IRP. While this is commendable, two significant concerns threaten this regulatory mechanism. Firstly, very few utilities (aside from Eskom) have experience in this methodology. Secondly, it may be difficult for the NER to enforce this. If this requirement is formalised, it is almost certain that the NER will have to establish methods for verification and it is unclear that the NER has the capacity to do this.

7. Sum-up: where to from here?

'Energy efficiency' and 'demand-side management' are new concepts for most in South Africa. It is therefore not surprising that overall DSM investment by customers, utilities and governments has been minimal relative to investment in DSM's so-called alternatives (e.g. household investment in incandescent lights instead of CFLs; network upgrades instead of load management at distributor level; and power plants instead of DSM at generator level). In the light of the fact that DSM investment can deliver significant national benefits,[12] this study has sought to question why investment has been sub-optimal. Some liberal economists may argue that the fact that the market is not investing in this area (in particular, in energy efficiency) is reason enough to conclude that it is not valued by society and should therefore not be taken up. If it is recognised, however, that barriers inhibit the market's investment in DSM, then this classical argument does not necessarily continue to apply. Assuming a Keynesian-type approach, this report seeks to identify these barriers with a view to seeking mechanisms and/or strategies to remove, or at least reduce, these market impediments. If these barriers continue to persist after intervention (and if there is a satisfaction that the intervention was implemented successfully) then perhaps one could conclude that it is not worthwhile continuing with the initiative(s). Given the proven monetary savings (and other benefits) that DSM – in particular energy efficiency – can release, it is perhaps reasonable to assume for now that this will not be the case. The contention of this report is that *optimal DSM investment is yet to occur, not because utilities and customers deem DSM to be unworthwhile, but because of the significant barriers impeding its establishment.*

In summing up this report, five broad observations are made. They are as follows:

Barriers inhibiting investment in energy efficiency are the most serious of all barriers inhibiting DSM investment. In this report, barriers preventing investment in strategic growth, load-shifting, interruptibility and energy efficiency were identified. Of these different types of DSM, barriers inhibiting investment in energy-efficiency-type DSM are most significant, and probably the most concerning. This is currently the case from residential, commercial and industrial customers' perspective, as well as from the perspective of

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[12] Numerous studies support this conclusion.

municipalities, Eskom and government. The broad reason for this sub-optimal investment on these different levels is that DSM is currently too 'expensive'. Household customers cannot afford energy efficiency's upfront costs. Neither are they prepared to shoulder the risk associated with an investment in an 'unknown' technology. Industrial customers are faced with more important priorities, and, like commercial customers, find it hard to justify investing in new equipment – albeit efficient equipment – when the equipment that they are currently using is paid for already and works adequately well. For distributor utilities – including Eskom – energy efficiency DSM goes against the grain of the ultimate business driver of utilities: unlike load-shifting, strategic growth and interruptibility, energy efficiency DSM brings about *an overall reduction in kWh electricity sales.* That there are significant barriers at all levels associated with with this type of DSM is reflected in the number and nature of energy efficiency DSM investments that are currently being made by customers, municipalities and Eskom, as well as in the size of South Africa's energy service industry. Following international trends, it is likely that, as the South African electricity industry restructures, investment in energy efficiency DSM will continue to be sub-optimal – and in all likelihood is probably set to decline further. If this public-purpose good is to be protected in the new ESI context, it will be important that barriers currently inhibiting its investment are scrutinised, and that policies and programmes are geared towards removing or reducing these barriers. An important question to be answered is whether in fact distributor utilities should still house energy efficiency DSM or whether provision of this public purpose good is best carried out elsewhere.[13]

Affordability barriers extend through small residential customer to large industry and utility. If policy makers are able to make a success of DSM – in particular energy efficiency DSM – in the new contexts, attention will have to be paid to removing or reducing economic barriers associated with the investment. As noted above, residential customers cannot afford DSM because it of the high initial monetary outlays associated the purchase. The same can be said of the barriers faced by industrial and commercial customers. Distributors do not find it in their economic interest to undertake DSM – it reduces overall sales. This problem is intensified when the economy is in downturn. Indeed, Eskom Distribution currently appears to be more concerned about increasing sales than they are about peak impacts of increased demand. Government does not have the resources to build programmes and capacity in this area. It is likely that these barriers will persist as the electricity industry is restructured.

Information barriers are relevant to most industry stakeholders. In the same way as affordability barriers are seen as being relevant to all industry stakeholders, so too are the information barriers discussed earlier in this report. Residential customers do not know enough about energy efficiency and other types of DSM to feel that it is worth the risk. The same can be said of commercial and industrial customers – faced with other business pressures, energy efficiency is not viewed as being desirable even though it can most times be shown that it will provide significant benefits to these businesses. Utility staff are often resistant to DSM because it is yet to prove itself as a viable option able to compete as an alternative to system expansion. Given significant data gaps, utilities continue to search for appropriate methods to evaluate DSM options such that they are on a par with supply options. Again, if DSM is to survive restructuring, these information barriers – which are likely to remain and probably intensify as restructuring progresses – will need to be addressed by industry policymakers.

Investment in strategic growth, load-shifting and interruptibility continues to occur where it 'makes financial sense'. As noted above, barriers inhibiting investment in energy efficiency investment are significant. Investment in other forms of DSM (i.e. load-shifting, strategic growth and interruptibily tend to occur when it is economically feasible for such investment to occur. Barriers inhibiting this type of investment do not seem to be as discouraging. This type of investment seems to be 'taken up by the market' in the form of contracts or negotiated agreements between different parties (for example, between Eskom and large customers, or between local authorities and residential customers). Generally speaking, where opportunities to undertake load-shifting or interruptibility are available in the industrial sector, they have been taken up already. On a commercial and residential level, customers (and

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[13] See Clark (1999) for a review of international experience in this regard.

municipalities) appear to be more open to loadshifting and interruptibility DSM than to energy efficiency DSM. Perhaps this is because these types of DSM yield tangible benefits with immediate effect and little (if any) upfront investment is required.[14] In the case of these DSM options, the challenge to policy makers and programme designers in new electricity contexts will be to address the barriers which will continue to persist as restructuring takes its course (for example, that industry is faced with other perhaps more urgent priorities or that customers do not support utilities controlling their facilities) as well as to address new barriers brought about by restructuring (for example, that there will be competition for customers). Unlike energy efficiency DSM, it is unlikely that policymakers would need to consider treating load shifting and interruptibility DSM as public purpose goods. The reason for this is that the benefits of these DSM options are captured by programme initiators and participants.

Different people have different understandings of the nature of DSM. It has become apparent that different people in different institutions have varying understands of what DSM actually is. Most people recognise that DSM involves load-shifting and interruptibility activities; fewer consider energy audits, demonstrations and information campaigns to fall within the category of DSM. Further, some energy sector stakeholders have added 'their own' DSM options to the conventional definition of DSM – that is, 'planning and implementation of utility activities designed to influence the time, pattem and/or amount of electricity demand in ways that would increase customer satisfaction, and co-incidentally produce desired changes in the utility's load-shape' (Gellings 1989). Some representatives from municipalities include prepayment meters, for example, as tools to bring about DSM outcomes. Others classify the way that municipalities manage their wholesale purchases from Eskom as a DSM-related activity. While customers utilising prepayment meters may indeed consume less electricity than they would had they received a monthly electricity bill, this is strictly speaking not a DSM option because it was never the intention of the utility to reduce electricity consumption (to the contrary, prepayment meters were originally installed to improve service payment records) and because the vital 'customer satisfaction' focus is missing. Similarly, while municipalities may utilise their own generation facilities or negotiate special tariff packages and, in so doing, are successful in managing their own demand profile, again the customer focus integral to the DSM concept is irrelevant. The importance of this point is as follows: as the electricity industry awaits restructuring, and as opportunities to implement DSM either become scarcer – as would be the case with energy efficiency DSM – or more specialised – as with load-shifting and interruptibility DSM, municipalities seeking to renew or maintain operating licences (and thus abide by DSM implementation requirements) may seek to suggest that these types of activities fall within the category of DSM. The challenge to the policymaker in this regard will be to develop mechanisms to verify that true DSM is being undertaken. Indeed, if this potential barrier is not considered seriously, DSM will have little chance of succeeding in the new context.

Barriers inhibiting investment in DSM – in particular energy efficiency DSM – can be divided into three categories:

- *Barriers currently inhibiting investment in DSM and likely to remain as ESI restructuring progresses.* Examples of these include customers unwillingness to allow distributor utilities to control their facilities, capacity institutional and resource constraints, inelasticity of customer electricity demand, inaccessibility to technology, etc.
- *Barriers currently inhibiting investment in DSM and likely to be removed or at least reduced by ESI restructuring.* Barriers of this nature include uncertainty regarding the future structure and ownership of the electricity industry, unfair competition (Eskom versus municipalities); choice of wholesale supply tariff etc.
- *New barriers introduced by electricity industry restructuring.* Examples of these barriers include price competition, unclarity with regard to where in the new context DSM should be

[14] On the other hand, relatively few customers appreciate the fact that energy efficiency does not mean that customers must 'put up with a reduced level of service'. In addition, energy efficiency generally requires a capital outlay by households, the benefits of which are only recouped over a period of time.

housed, institutional separation making DSM less fundable, or that municipalities will be cross-subsidising other services with revenues from electricity etc.

Given various possible electricity industry scenarios, the next report in this series will seek to identify new barriers introduced by electricity industry restructuring (see third barrier category above), as well as current barriers persisting through the restructuring process (first barrier category). Again, if policymakers and others are serious about protecting investment in DSM in the new electricity industry contexts, they must take cognisance of these barriers. The fourth report in this series will seek to recommend mechanisms, organisation and resources structures which, taking account of these various barriers, are geared towards making a positive impact in this area.

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APPENDIX A

People interviewed for this study

Mr George Adams	Loxton Municipality
Mr Albert Africa	Eskom
Ms Erna Alberts	Eskom
Mr Neil Ballantyne	Cape Town Municipality
Dr Wolsey Barnard	National Electricity Regulator
Dr Kevin Bennett	Energy Research Institute
Mr Andy Berrisford	Eskom
Mr Barry Bredenkamp	Eskom
Mr Retief de Villiers	Pretoria Metropolitan Council
Ms Elsa du Toit	Department of Minerals and Energy
Mr William Dykman	Pretoria Municipality
Mr Deon Conradie	Eskom
Dr Mike Ellman	National Electricity Regulator
Mr Don Early	Cape Town Municipality
Mr Andrew Etzinger	Eskom
Mr Mike Gitting	Durban Metropolitan Council
Mr Mike Hendricks	GH Marais and Partners
Prof. Dieter Holm	University of Pretoria
Mr Manfred Kuster	Cape Town Municipality
Prof Ian Lane	Energy Efficiency Enterprises
Ms Sharon Lewis	Department of Housing
Mr Trevor Molt	Kimberley Municipality
Mr Rory Muldoon	Eskom
Mr Lucas Muller	Centurion Municipality
Mr Piet Naude	Eskom
Dr Tony Surridge	Department of Minerals and Energy
Mr Rob Surtees	Eskom Enterprises
Mr Isaak van Gas	Eskom
Mr Brian van der Watt	Ceres Municipality
Mr Archie Wearne	Worcester Municipality

APPENDIX B

Case studies: Municipal DSM investment

Case study I: Cape Town Municipality

DSM initiatives

Cape Town Municipality does not have any active DSM programme that targets customers and seeks to alter their normal patterns of electricity consumption, or encourage greater efficiency. There is no perceived need for such activities. All the load management that is currently required to smooth the municipality's load profile with Eskom distribution is provided by its Steenbras pumped storage station, the Athlone power station and gas turbines. Indeed the municipalities demand profile is said to be 'as flat as Table Mountain'. At present, Athlone power station is only operating at about 40-60 MW even though it has a capacity of 180MW. Steenbras has a maximum demand of 100-120 MW. In summer it is operated according to a weekly cycle that flattens the weekday peaks and allows for maintenance over weekends. The amount of electricity generated in summer is limited by the size of the lower reservoir in the system. In winter the amount of electricity generated is less constrained. When the lower reservoir is full the water is allowed to flow into the sea. This is possible given the winter rainfall.

It was noted that all the power stations operated by the Cape Town Municipality were specifically designed to fulfil a particular role within the local distribution network. It was therefore argued that it would not be advisable to transfer these power stations to the local RED that is to be formed rather than placing them in a large generation pool. This would allow them to be used for the purpose for which they were designed rather than simply generating power into a national pool.

Cape Town Municipality currently purchases electricity from Eskom Distribution on the 'standard night-save tariff'. This tariff is structured around two blocs of time: 6am to 11pm when maximum demand applies and 11pm to 6am when there is a standard low cost rate. This allows the municipality to use large amounts of low-cost electricity at night for pumping water in the Steenbras scheme. The municipality does offer a similar 'night-save' tariff to large industrial and commercial customers. Of the around 600 industrial customers very few are able to shift load due to the nature of their work organisation. For instance, cold storage operators have to work during the day and so use most electricity then. A number of commercial customers have taken advantage of the lower energy charge at night time, especially those operating heating and air-conditioning plant. However it is not clear whether this has simply enabled them to save on normal operations or whether there has been some load-shifting. The municipality only gathers information on total energy use and not the time of use, so it is not possible to determine the DSM effect of this tariff.

It is reported that Cape Town Municipality is interested in the wholesale electricity tariff (WET) that is currently being developed by Eskom and the NER as it would make an important contribution to levelling the playing field between Eskom Distribution and the municipal distributors. This wholesale tariff would have to be a cost-reflective tariff in line with current policy. This would mean that the cost of bulk electricity would differ across the country due to different transmission costs. Currently, Eskom Distribution's end-user tariff, say, to domestic customers is the same across the country, whereas it charges municipalities according to tariffs that tend towards being cost-reflective. This means municipal tariffs often have to be higher than that charged by Eskom Distribution.

The municipality does not operate any ripple control or radio control on geysers. Apparently, the necessary switches were originally installed in the older residential areas such as Sea Point and Rondebosch during the 1950s and '60s, but have not been used for a long time. Indeed it is not clear whether the equipment for sending out the ripple control signals still exists. Switches have not been installed in any of the newly electrified areas.

It is reported that one of the principal problems with investing in a geyser control system is that the pay-back is too uncertain. If, for instance, winter peak is expected to be 820 MW and a geyser control system is installed to reduce this to 800 MW, but due to a mild winter the peak is only 790 MW, the municipality will be unable to generate any return on its investment. Instead of being able to recoup costs over a three-year period it might take five years. This is too uncertain and too long given broader uncertainties regarding the future structure of the distribution industry.

One of the people interviewed noted that when he received complaints from people about the level of their electricity bills, he would recommend that they install a time switch on their geysers. This, he says, can reduce a household's electricity consumption 'substantially'.

As regards education initiatives to encourage electricity efficiency, it is reported that the municipality does not have the necessary capacity, and there is no clear need from the municipal perspective to do such training. The municipality (in partnership with Eskom) does nevertheless employ one community education officer at the Joint Service Centre who visits schools and women's groups to educate people about electricity, including safety, uses, efficiency and the operation of the pre-payment meters. The municipality also employs two 'community marketing officials' who visit areas and interact with communities that are either about to be electrified, or have been recently electrified. Again the aim is to educate people about electricity generally, rather than focusing on encouraging efficient electricity use specifically.

The municipality does not offer any form of 'customer service' to its industrial or commercial customers aimed at either encouraging them to use electricity more efficiently or to substitute other energy sources with electricity. It was noted that in the past the council expressed the view that these services were available from consulting engineers and that it would be unfair competition for the council to offer such services. However, it was pointed out that experience with the services provided by Eskom's Industrilek and similar divisions shows that they compliment those offered by consulting engineers. Nevertheless the municipality is still unwilling to invest in developing the capacity to deliver such a service given the uncertainty about the formation of REDs.

One of the people interviewed noted that an unintended consequence of the pre-payment metering system is that it raises households' awareness of their electricity consumption and thus encouraged them to use it more efficiently: switching off lights, using the microwave and not the stove etc. He estimated that households with pre-paid meters consumed about 5% less electricity than would otherwise have been the case. This is a substantial saving given that pre-payment meters have been installed for 200 000 of the 380 000 domestic customers supplied by the Cape Town Municipality.

Two or three years ago there were capacity problems on the transmission line that supplied Hout Bay due to the fact that there is 'a large demand at the end of a long line'. Various options of dealing with the problem were looked at and it was decided to strengthen the network link rather than undertake any DSM. It was felt that the possible DSM investments would be better spent on strengthening the network given that demand is growing rapidly in the Hout Bay area. The person interviewed agreed that there is probably a general bias towards strengthening the network rather than on trying to manage demand.

Overall the municipal transmission and distribution systems are very robust and so there is no need to offer customers time-of-use or interruptible tariffs. The municipality can offer customers a 100% secure supply of electricity at all times.

Barriers to DSM

- Uncertainty about the future of the electricity distribution investment brings with it the threat of stranded DSM investments.

The principal barrier to DSM identified during the interviews was the view that load management is best addressed by using own generation, rather than any actual SM measures.

There is a bias towards strengthening networks rather than trying to postpone such investments with DSM.

The municipality does not collect the information needed to evaluate DSM measures properly.

Case study II: Ceres Municipality

DSM initiatives

Ceres Municipality is one of the three small local authorities in the country with their own hydroelectric plants. The others are Piet Retief and Lydenburg. The installed capacity of the Ceres hydroelectric plant is 1MW. In the past the reservoir supplying the plant was very small and it could therefore only be used effectively during the rainy season in the winter months, and then it was run on a continuous basis, as opposed to simply for peak lopping. The municipality has just completed building a large dam 3km above the plant. It took three years to build and due to its size and the limited water supply it will take a number of years to fill. The power station is therefore not being fully utilised at the moment. The plan is, however, to generate electricity throughout the year. Given that the head of water supplying the turbine is 400ft, it may be feasible to install another turbine about halfway up the pipe to optimise the use of energy. A feasibility study is currently being undertaken.

Overall the generation of electricity is very profitable for the municipality. The turbines are linked directly to the Eskom grid and not the municipal grid. Ceres is therefore a cogenerator. The amount of power supplied to Eskom is measured and charged for at an agreed rate. Eskom then deducts this amount from the municipality's electricity bill each month. The municipality can also use the electricity it generates as an emergency supply for essential services such as sewerage and water pumping.

Ceres is also different from many other municipalities in that its winter peak is lower than its summer peak. Indeed its load profile is 'almost a mirror image' of that for Eskom, because Ceres has a large industrial consumer base involved in the fruit processing industry (cold storage, canning, juice etc) which is most active in March and April. This means that if Eskom were to adopt a seasonal time of use tariff structure it would favour the municipality. From an Eskom perspective Ceres' consumption falls neatly into the 'valley filling' category of load management. It also means that a local IRP would come to very different conclusions to the national IRP.

Ceres is in the process of moving to one of the time-of-use tariff options. It is hoped that this will be done before the end of the year or at least in time for the fruit season in March 2000. Simulations carried out by consultants a number of years ago, based on the contract time-of-use tariffs then offered by Eskom, showed that the municipality would benefit. However, the implementation has been delayed by the changes to tariff policy introduced by the NER and the time it has taken to approve a general time-of-use tariff as proposed by Eskom. The municipality intends to pass the benefits of the time-of-use tariff on to its industrial customers by offering them similar tariffs.

A number of years ago the municipality was facing the prospect of having to increase the capacity of its link to the Eskom grid as a result of demand growth. In order to postpone the timing of the investment the municipality offered domestic customers a tariff price incentive to install load breakers, and co-operated with industrial consumers to take measures around power factor correction and load control. It is estimated that these measures postponed the need for the new connection by about three years.

At present Ceres does not use ripple control on domestic geysers, partly because domestic consumers represent a small percentage of the total (i.e. peaks are caused by industrial and not domestic consumption), and partly because the funds needed to under take a feasibility study and to install the technology are not available. The view was expressed that it would be viable but that the start-up costs are an obstacle. Indeed there is not even enough funding to undertake an initial feasibility study.

Ceres also does not run any educational programmes on safety or efficiency of electricity use. Apparently this is a 'sore point' given that the electricity department believes the municipality should be offering this training as it can be combined effectively with initiatives aimed at 'revenue protection'. At the moment they simply pass on the information pamphlets that they receive from Eskom.

Over the past five years 1500 RDP houses have been built in Ceres. This represents 20% of the housing stock of Ceres, which is currently between 5000 and 6000 houses. The natural growth in the upper income housing stock is about 5%. The municipality does participate in the planning of housing schemes, but does not give any attention to thermal efficiency in the design of houses where the driving factor is trying to maximise the floor space under roof. No attention is paid to orientation, which is determined by the road layout and is, from an orientation point of view, 'random'.

All new low-income houses are installed with pre-payment meters. Customers with these meters enjoy a lower tariff, which is based on the life-line tariff concept. As a result other consumers with mechanical meters are having pre-payment meters installed. The special tariff is thus acting as a price incentive for customers to shift to a new metering system. It is reported that the start-up consumption of newly connected homes is very low, but doubles within about two years.

Barriers to DSM

A lack of personnel (capacity) to offer customer services, which would include training around efficiency, safety and revenue protection.

A lack of funds to study the financial feasibility of different DSM options, and then a lack of capital needed to make the initial investment.

A lack of information about how the municipality is performing relative to other municipalities. The view was expressed that managers at the municipal level operate in a vacuum not knowing whether they are performing well or not, and therefore with little incentive to improve.

The lack of accurate consumption data hampers efforts to evaluate the viability of DSM projects.

Case study III: Durban Municipality

DSM initiatives

Durban Municipality is the largest municipal distributor that does not have its own generation. Durban purchases electricity from Eskom Distribution on the Megaflex tariff. When Durban converted to this tariff about five years ago, the municipality negotiated a discount to the set tariff on the basis that it would pass on the time-of-use tariff to as many customers as possible. Initially customers with loads greater than 1 MW were given access, now access is open to any customer that can show that they would benefit from it. The aim is to extend time-of-use tariffs down to all customers with loads greater than 100 kW. It is, however, taking time to put the appropriate meters in place and develop the necessary technical support. The view was expressed that eventually time-of-use tariffs should be extended to all customers. It was argued that this would be to the advantage of poor customers as they could plan their consumption for off-peak times and thus make substantial savings without much loss in quality of service. Bringing higher domestic users onto time-of-use tariffs would encourage them to take measures to shift load (e.g. a timer on their geyser) and also encourage efficiency.

Despite Durban's size, the municipality is unable to compete with Eskom Distribution when it comes to offering large industrial customers competitive tariffs. This is because Durban has to buy its power from Eskom Distribution. This reportedly gives rise to the unusual situation where electricity tariffs are lower in rural areas and smaller towns supplied by Eskom Distribution than they are in Durban. The difference in tariffs between Durban and Richards Bay is particularly large, and results in Eskom Distribution being able to 'cherry pick' Durban's largest customers. For instance Mondi has opted to build a new paper mill in Richards Bay rather than Durban

because of the lower electricity tariffs offered by Eskom Distribution in Richards Bay. The view was expressed that this unfair competition is giving rise to an artificial distribution of businesses.

Durban relies on load factor correction to manage its peak. It does not have a geyser control system, nor does it shed load by switching off streetlights. It also does not use circuit breakers to limit load – 40 amp breakers have been installed across the board. From the municipality's perspective Eskom Generation has most to gain from a ripple control system in terms of avoided costs of new generation, and should therefore pay for the investment. At present the potential savings to the municipality are not sufficient to justify investment in a ripple control system. Another factor that reduces the viability of a ripple control system is the fact that water entering geysers in the Durban area is substantially warmer than inland. This means geysers do not switch on as often *and* use less energy to heat the water.

As regards network management, there is a bias towards strengthening the network as soon as demand makes this necessary. Very little is done to try and curtail demand in order to postpone investments in networks.

The municipality does use pre-payment meters in newly electrified areas, but does not promote their wider use. Existing customers may apply to install pre-payment meters but have to do so at their own expense. The person interviewed noted that the electronics in pre-payment meters have a life span of just six years, while the mechanical metres can last up to 40 years and longer. The cost of maintaining an extensive number of pre-payment meters is therefore regarded as prohibitive.

The municipality has an industrial sales officer who advises large customers on cost-effective energy use. The municipality does not have the capacity to undertake comprehensive energy audits, but the officer does focus on the major areas of energy use in a customer's operations and identifies ways of improving efficiency. For instance, in the hotel industry substantial savings have been realised by moving to time-of-use tariffs and using timers to regulate geysers, air-conditioning and cleaning equipment.

Durban Municipality runs quite an active education programme, using brochures, adverts in public places and radio campaigns. The municipality also employs a number of marketing assistants who visit schools and communities. These activities focus mainly on safety and tariff issues, but also encourage energy efficiency.

Durban's electricity department does not advise on new developments in order to ensure that they take advantage to lost opportunity costs. The view was expressed that given Durban's relatively mild climate it is less of an issue than it is in other areas of the country.

Barriers to DSM

The process of moving to the wider implementation of time-of-use tariffs is being delayed by the availability of reliable metering equipment at an appropriate price.

Very few municipalities look beyond electricity for meeting people's energy needs. The view was expressed that municipalities need to focus on becoming energy service providers, and offer clients a range of appropriate energy options including solar heating and gas.

There is a supply-side bias within the municipality to the extent that it would prefer to invest in network upgrades than invest in DSM programmes.

The failure to consider what is in the best interests of the country often results in one-dimensioned decisions being taken in the electricity sector.

Case Study IV: Kimberley

DSM initiatives

Kimberley purchases electricity from Eskom on the Standard Rate tariff. The municipality is keen to move to a time-of-use tariff and is hoping to do so in next year. To date, the equipment to pass the benefits of a time-of-use tariff on to consumers is not in place, but this has now been installed. The municipality is using the remainder of this year to make larger customers aware of this tariff option.

The Kimberley Municipality does not supply electricity to the surrounding mines. Even those 'right on the outskirts of the town' buy their power from Eskom distribution. This means that Kimberley's customer base is dominated by domestic users, and only a limited number of commercial and industrial customers. It was noted that it would be very beneficial for the town's demand profile to be able to supply the mines as well. It is hoped that the formation of the REDs will consolidate distribution activities in the area and offer substantial benefits to Kimberley's customers.

Kimberley was among the first towns in the country to install a ripple control system on geysers. As a result it is one of the few towns that uses the Landerson Gear System. This system is, however, proving expensive to maintain and there are plans to change to a more widely used system. The municipality's demand profile is actively monitored and managed. The municipality has an agreement with Eskom to shed load at Eskom's request. In emergencies the municipality can use the ripple system to switch off streetlights in order to manage the load. The ripple system can be used to shed between 6 to 8 MW of load, which is between 8 and 10 per cent of the town's maximum demand.

Kimberley offers commercial and industrial customers a night-save tariff. Between 6pm and 8am the tariff is R9.88/kva and R48.02/kva during the day. Any customer that can show on the basis of a feasibility study that it may be in their interests to move to this tariff can apply to the municipality to do so. The municipality also actively markets the tariff but, given that electricity is relatively expensive in Kimberley, emphasises the overall 'basket of tariffs' (water, electricity, rates and levies) available to industrial and commercial customers.

For the past number of years the municipality has been working in partnership with the private sector to educate people about the use of electricity. They operated a bus that went to schools as a sort of mobile education lab. The municipality is now negotiating to buy this bus with a view to continuing this service. The client services department has also a joint venture with Eskom around education, and members of the electricity department's management are actively involved in developing literature for this purpose. The client services department also visits large customers and informs them of cost-saving opportunities, such as load factor control.

The municipality installs pre-payment meters in low-cost housing developments. Other customers can have these meters installed as well, but have to pay for the installation. There is no active programme to get all customers to use pre-payment meters.

The person interviewed noted that although the electricity department is 'sensitive to lost opportunity costs' the different departments in the municipality do not communicate with each other very effectively and so when it comes to planning housing developments the town planners 'do their thing' and the electricity department supplies the electricity. As a result, virtually no consideration is being given to developing energy efficient housing. He noted further that efforts in this direction are also hampered by the manner in which the low-cost housing scheme is being implemented and the level of subsidy available. Nevertheless, it was noted that the recent work around a Comprehensive Urban Plan for Kimberley had raised awareness of the need for greater co-operation between departments and disciplines and it was hoped that this would be given effect by the integrated planing process.

The electricity department reports regularly to the local council on a range of performance measures, including the NRS 048 parameters. This process has been useful in raising councillor's awareness regarding electricity supply issues and made it easier for the electricity department to get certain cost saving expenditures passed than might otherwise have been the case.

Barriers to DSM

Kimberley's customer base is dominated by domestic customers, which means that apart from ripple control there is not much scope for significant savings with other load management type DSM initiatives.

It has taken time to install the necessary technology to move over to time-of-use tariffs. This is now possible, but it is not clear when such a wholesale tariff is going to be available.

Eskom Distribution 'cherry picks' all the largest customers in the Kimberley area – mostly diamond mines – and also sells electricity to the municipality. This undermines the municipality's capacity to compete effectively with Eskom Distribution and limits the municipality's load management DSM options.

Case Study V: Loxton

DSM initiatives

Loxton is a very small town in a remote area of the Northern Cape. It has just 36 streetlights. The municipality supplies some 80 customers. The town was electrified some 15 years ago as part of Eskom's drive to gain customers in order to use the excess generation capacity it had built. According to the person interviewed it would have been more cost effective to build a solar powered plant for the town. Apparently plans for such a plant were drawn-up but were rejected by the government because Eskom said it could provide electricity more cheaply. However this was only possible because Eskom subsidised extensions of the grid to remote areas with electricity sales in urban areas.

Currently, Loxton purchases electricity from Eskom on the 'maximum demand tariff'. However, because of the predominance of domestic customers the peak is very high relative to the number of units consumed. As a result the municipality is making a loss on the sale of electricity (R36 per extra 1 kw makes a tremendous difference). This situation is being aggravated by the fact that people are beginning to install geysers and by the increase in weekend visitors to the area. Apparently weekend visitors can result in the peak doubling from 50 kW to 100 kW. The cost impact of this for the municipality is not recouped by the number of units they consume.

The municipality does differentiate between commercial and domestic customers, adding an extra R30 to the bill of the former. Otherwise all customers are charged at 25c/kWh.

Barriers to DSM

There are limited finances to invest in ripple control devices to manage geysers.

The high cost of solar water heaters relative to electrical geysers.

The very small size of the municipality, the lack of diversity in the customer base and therefore the lack of options when it comes to managing electricity consumption.

Case Study VI: Pretoria Metropolitan Council, and Municipalities

DSM initiatives

Pretoria Metropolitan Council

The Greater Pretoria Metropolitan Council purchases electricity from Eskom Distribution on behalf of its constituent municipalities. In many senses the Metro Council acts as a single purchaser and seeks to manage demand at the metropolitan level in order to minimise the cost of electricity for the municipalities (Pretoria, Centurion and Akasia). To this end the Metro Council also manages the Pretoria North and Rooiwal power stations. At present the Metro Council purchases electricity on the Megaflex tariff modified by certain 'special capacity displacement deals'. Eskom has concluded these special deals in order to get the Metro Council to minimise the use of its power stations. Basically Eskom has agreed to supply electricity at certain times of day more cheaply than the Metro Council can generate it with its own power stations. Nevertheless the Metro Council is still using its power stations for peak lopping and when the comparative prices between Eskom supply and own generation justify it. Electricity demand is forecast each month, the cost of Eskom and own generation supply options are compared and then the own generation is scheduled accordingly. The person interviewed

noted that if there were no special deals the Metro Council would be far more proactive in monitoring the peak and dispatching its own generation. He suggested that this could be done in half-hourly time slots.

The Metro Council on-sells electricity to its constituent municipalities. By agreement it has no end-use customers of its own. The tariff used to do so is the Megaflex tariff modified by the cost savings realised by the use of Metro's own generation. Thus the benefits of consolidating the entire Metro's relationship with Eskom and of the own generation capacity is passed on to the different municipalities. In the case of Centurion this has brought significant cost savings because:

(i) The Centurion peak is half an hour earlier than the overall Metro peak and is also lower than the Metro Peak,

(ii) Centurion benefits from a higher bulk link to Eskom at the Metro level, and hence a lower unit charge on electricity purchased from Eskom,

(iii) Centurion now has access to the benefits of the peak lopping activity of the own generation operated by the Metro,

(iv) By joining together, the municipalities have diversified their collective customer base which has resulted in a more cost-effective demand profile, with cost savings for the individual municipalities.

Another benefit of consolidating the municipalities' demand into the Metro is that it gives Metro's power stations a far greater peak to work against when it comes to peak lopping. It also gives the Metro far greater bargaining power vis-à-vis Eskom, than the individual municipalities had in the past.

It was noted that further economies of scale could be realised if the current Metro electricity management system were extended to include neighbouring areas. However, doubts about the effectiveness of having a RED that covered the whole of Gauteng were expressed. It would simply be too large to manage effectively and would undermine any possibility of a contestable market, even only at a comparative level.

Centurion Municipality

The Centurion Municipality operates ripple control system on domestic geysers. About 20 000 domestic customers are part of the system. The installation of new switches was suspended about three years ago to allow the electricity department to use the finances to upgrade its control room. Installations have resumed this year, but it will take about six years to cover the backlog and deal with a rapidly growing consumer base. The municipality stipulates that all houses that are sold must have the switch installed as part of the process of obtaining a wiring certificate.

Centurion uses the ripple control on geysers proactively, rather than simply according to a fixed schedule. In other words the municipality's peak is actively monitored and manipulated as it develops. The municipality can also switch off its streetlights in order to manage its peak, but this system is only used in extraordinary circumstances. In the last eight years it has only been used twice. (Apparently the ripple control system is also used to synchronise all the municipality's traffic lights.)

In Centurion domestic customers who do not want ripple control on their geysers can contract with the municipality to switch the device off. The municipality adds between R50 and R70 per month to such customers' electricity account. These contracts also apply for a full year to prevent people switching off for winter and on for summer. Only about 0.5% of domestic customers have entered such contracts.

Centurion offers all commercial and industrial customers the option of a time-of-use tariff if they use more than 1 MW of electricity. However, only three or four customers are large enough to take advantage of this, one being a mine.

Pretoria Municipality

Pretoria Municipality, unlike Centurion, does not have any ripple control on geysers installed. This is because the power stations that now fall under the Metro belong to the Pretoria Municipality and in the past were used to manage its peak demand, as opposed to that of the entire Metro as is now the case. According to the person interviewed, installing ripple control on domestic geysers is definitely financially viable, but that the investment cannot be undertaken given current uncertainties with regards to the restructuring of the electricity industry. In addition, the council is not prepared to commit itself to a large investment that is only likely to generate a return over a five-year period and that is of a 'technical nature' rather than 'concrete'. In essence, councillors give greater priority to short-term, vote-catching social responsibility investments. The opinion was expressed that as soon as a RED is formed it would have the necessary independence, access to finance and a medium-term planning outlook that would allow it to undertake such an investment. It would be a massive undertaking given that there are some 200 000 households that would need to be fitted with switches. Investments that have a very rapid payback period, such as load factor control, have been undertaken recently.

Pretoria Municipality offers night-save or time-of-use tariffs to large consumers. These have been taken up by ISCOR, the CSIR and vehicle manufacturers. Indeed, as in Centurion, these tariffs are available to any customer that can put forward a feasibility study showing that moving to such a tariff 'might' be in the firm's interest. The only condition then is that the firm pays for installing the new metering equipment.

The Pretoria Municipality installs pre-payment meters in low-costs houses, but prefers the old mechanical credit meters for other developments because they cost less to maintain. It is was reported that the electronics of the pre-payment meters are particularly susceptible to damage by lightning and so are not suited to the Gauteng area.

Both Centurion and Pretoria electricity departments are prepared to advise developers on energy efficient building designs, but do not provide such a service as a matter of course. It was, nevertheless, noted that both have the capacity to do so and it would undoubtedly be better utilised in a REDs environment.

Barriers to DSM

It is reported that the restructuring of the electricity industry has resulted in less uncertainty for Centurion than the mega-city concept and the restructuring of municipal assets and departments that may result from that process.

Councillors require tangible vote-catching investments. DSM investments are not sufficiently 'concrete' and so although they may generate substantial savings for municipality they are given a lower priority than more visible projects that make a loss.

The size of investment required to make ripple control effective in the Pretoria Municipality is large and requires a concerted effort to make it effective. The capacity to manage this at the political level does not exist at present.

Case Study VII: Worcester Municipality

DSM initiatives

Worcester is on the Eskom 'A-tariff' or maximum demand tariff. This means that there is an incentive for the municipality to control the load peak. Due to the rapid growth in domestic consumption relative to industrial consumption the municipality has an evening peak for ten months of the year. Previously the peaking pattern used to be divided more or less evenly between morning peaks for the summer months and evening peaks for the winter months. At present there are 3500 radio controlled geyser switches installed in mainly middle- and upper-income houses. These are used for brief periods to knock the peaks off the municipality's demand profile. It is reported that the number of switches could be doubled to 7000 and that the benefit of doing so would be significant. However, because of the emphasis placed on the

delivery of other basic services, housing and electrification the finances for such a project are not available.

The municipality also offers off-peak incentives for certain industrial consumers, eg bakeries, but very few have actually taken them up. Shifting to such a tariff would require a substantial amount of work reorganisation, and possibly the introduction shift or overtime pay which companies are unwilling to do.

The municipality considered changing to a time-of-use tariff with Eskom a number of years ago. However at the time, Eskom was only offering municipalities a time-of-use tariff that would have only benefited the municipality after a five-year period. It was noted that shifting to a time-of-use tariff would change the way DSM could be implemented at the municipal level. Instead of geyser-control being carried out almost surreptitiously customers could be offered explicit market-based incentives that would allow the municipality to install control devices and switch the geysers off during peaking periods. Customers that preferred not to participate in the programme could be charged a higher tariff.

The Worcester municipality recently had the capacity of its link with Eskom raised from 45 MW to 55 MW, and it was expected that, given the current growth in demand, this would be adequate till about 2003. There were currently no plans to encourage greater load factor control by industries as the benefit to the municipality would be limited, although there was scope for it. As noted the peak is mainly the result of evening domestic consumption. Efforts at using an off-peak tariff (50% of normal tariff) to get industries to shift their consumption has met with very limited success. The person interviewed, nevertheless, noted that there appeared to by substantial opportunities for private enterprises to offer industries a service around power factor corrections. He noted (with some disquiet) that companies presently providing this service concluded contracts to take 50% of the savings over five- to ten-year periods, but apart from the initial installation did not offer any back-up service. This he regarded to be inequitable.

The municipality has undertaken outreach programmes to schools on and off, but the programme has not operated for sometime due to the lack of capacity.

The lack of capacity and lack of initiative has also meant that no education has been done around 'lost-opportunity measures' in low-cost housing development. It was noted that there are substantial benefits to be had, but because of a lack of awareness and an emphasis on self-built homes these are not realised. The municipality only provides limited technical advice. Most of these owner-builders can simply not afford to invest in insulation, larger windows or ceilings, etc. The municipality is building a limited number of houses for very poor people, but in order to maximise the number of houses with the available resources, costs are being cut at every corner (for example, only the side of the house that receives the most amount of 'weather' is plastered)

All new houses are installed with pre-payment meters. And although these do not require regular meter readings, the personnel saved in this area are being used on auditing to identify theft of electricity. Currently a lot of effort is devoted to developing computer monitoring systems to do so.

Barriers to DSM

The lack of capital to undertake DSM investments, due to the prioritisation of other services, e.g. housing, sewerage, roads etc.

Customer resistance to DSM initiatives, because they do not recognise DSM's value.

There is resistance on the part of industrial consumers to reorganise their operations (and pay labour overtime) to take advantage of off-peak tariffs.

The capacity in terms of personnel to undertake customer education is limited.