Exploring the possible impact of electricity supply industry restructuring on demand-side management

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CONTENTS

1. Introduction

This paper explores the possible implications of restructuring the South African electricity supply industry (ESI) on demand-side management (DSM). It also introduces a discussion on how the restructuring process may be designed so as to promote appropriate DSM. Regarding the first area of focus, this paper will examine:

- how restructuring the ESI may alter different stakeholders' incentives to undertake DSM;
- how restructuring the ESI may impact on the kinds of DSM that stakeholders undertake, and;
- how restructuring the ESI may lead to the disappearance of existing barriers to DSM or result in the emergence of new ones.

After examining four scenarios or phases for the restructuring of the ESI in South Africa in section 2, these issues are discussed in sections 3 and 4.

Section 5 deals with the second area of focus. It draws on the information in the preceding sections to identify some of the trends and therefore some of the issues in the way restructuring is likely to impact on DSM across the different scenarios. This information informs a later paper in this series which examines the positioning of DSM in a restructured electricity industry and makes recommendations to government, the National Electricity Regulator (NER) and Eskom on the issue[1]. Section 6 concludes by summarising the most important DSM implications of ESI restructuring.

This paper is one of a series emanating from a project aimed at delivering recommendations to the government, the National Electricity Regulator (NER) and Eskom on ways to ensure that DSM is built into the restructuring process set to occur in South Africa. The first report in this series reviews international experiences of electricity industry restructuring and the impact these have had on DSM programmes. It draws lessons from what has happened in other countries that are likely to be relevant as the process of restructuring the ESI in this country gets under way. The second report investigates what barriers are currently inhibiting investment in DSM in South Africa faced by municipal distributors, Eskom, and end-use customers; it also looks at barriers resulting from government policy and regulation. This report is the third in the series, and draws on the first and second reports to evaluate what the implications restructuring the ESI will have for DSM. The fourth and fifth reports make recommendations on governance, regulation, funding and institutional arrangements on how to ensure that DSM is well placed in the new contexts.

2. Restructuring the ESI: What are the options?

Internationally, restructuring of power industries has involved changes in its *ownership* and/or its *structure*.[2] The focus of this discussion is primarily on the *structure* of the industry. The overall aim of this section is to provide a context for discussing the likely impact of ESI restructuring on DSM programmes in section 4.

Soon after the NER was established in 1995, a number of 'task teams' were set up to investigate various aspects of the ESI. Among these was the Electricity Market Task Team, whose brief was to 'make recommendations to the NER regarding the need for an electricity market in South Africa, as well as the required future structure, operation and commercial interfaces between the participants in such an electricity market' (NER 1996a). This task team examined four possible ways of organising the electricity industry: monopoly, single purchaser, wholesale competition and retail competition (these models are described fully by Hunt and Shuttleworth (1996) and reproduced in Clark (1999)). Although it did not make a specific

1 See Clark (2000).

2 See, for instance, Clark (1999).

recommendation as to which model should be adopted, it is evident that the task team favoured establishing a structure compatible with wholesale competition in the medium term.

The industry models outlined in the Electricity Market Task Team's report have strongly influenced the debate both around the restructuring of the electricity distribution industry (ERIC 1996) and the government's long-term vision for the electricity industry, as set out in the White Paper on Energy Policy (DME 1998).

The remainder of this section draws on these and other sources to outline:

- the current structure of the ESI ('status quo' scenario);
- the structure of the ESI after the proposed rationalisation of the EDI is complete ('REDs' scenario);
- the likely structure of the ESI should wholesale competition be introduced ('wholesale competition' scenario); and
- the likely structure of ESI should retail competition be introduced ('retail competition' scenario).[3]

2.1 The current structure of the ESI: 'status quo' scenario

Figure 1 illustrates how the generation, transmission and distributions sectors of the ESI are currently structured.

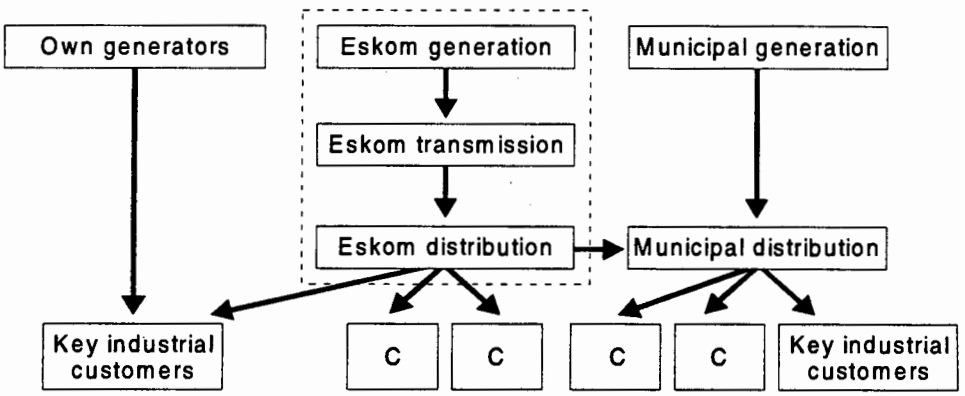

Figure 1: Current structure of the ESI: status quo scenario

Figure 1 illustrates that the ESI in South Africa is currently dominated by Eskom, a state-owned utility that has recently been corporatised. Eskom is also in the process of ring-fencing its various activities into separate entities dealing with generation, transmission, distribution and a range of auxiliary services (some of which have been lodged within 'Eskom Enterprises'.

The electricity generation industry is presently dominated by Eskom Generation, which produces approximately 95.1% of the electricity generated for resale in South Africa. The remaining 4.9% is generated by seven municipalities for distribution to their customers, as well as by a small number of companies which generate electricity for their own use. Eskom Generation is therefore virtually the monopoly generator of electricity for public use (NER 1998). Eskom Transmission operates nearly the entire transmission network which transmits electricity from power stations to all parts of the country, as well as to and from neighbouring countries (NER 1998).

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[3] Note that these scenarios should *not* be confused with the different phases for restructuring the EDI described in the Department of Minerals and Energy's *Call for Proposals on the Electricity Distribution Industry Restructuring Project* (DME 1999). These phases describe a possible way to manage the transition within the distribution industry from the current situation to the formation of REDs, and therefore focus only on the formation of REDs and do not deal with the introduction of wholesale competition, nor retail competition. In addition, they focus on possible institutional/company structures for the EDI and the associated ownership implications, rather than the relationship between generation, transmission and distribution as integrated sub-sectors of the ESI.

The distribution of electricity is undertaken by Eskom Distribution and approximately 380 licensed municipal distributors. Collectively the municipalities serve about 56% of all customers and distribute 42% of the electricity supplied to end-users (NER 1998).[4] Generally, municipalities serve customers in the areas under their jurisdiction. The municipal distributors vary greatly in size, geographic spread, customer density and base, as well as managerial capacity. Consequently the financial health of municipal electricity undertakings varies greatly. Eskom Distribution serves the rest of the customers, and has customers spread throughout the country. Most very large industrial customers are served directly by Eskom Distribution. All the municipal distributors also purchase electricity from Eskom Distribution.

As noted above, the NER was established as the regulatory authority over the whole electricity supply industry in 1995. Shortly after its establishment it required all generators, transmitters and distributors of electricity to apply for licences to undertake these activities. Permanent licenses were issued for generation and transmission on the basis that these sectors were operating fairly effectively and efficiently. However, the NER elected to issue only temporary licenses to electricity distributors because in its view there were serious questions regarding many municipalities' ability to meet electrification targets, set equitable tariffs and remain financially solvent. There is little evidence to suggest that the situation has changed significantly.

It is generally acknowledged that the EDI is in a state of crisis and in urgent need of restructuring.[5] The status quo model illustrated is therefore set to change in the near future. The scenarios that follow can either be regarded as alternative end-points to the imminent restructuring process or as successive steps towards an ultimate end-point (see discussion in section 3.2).

2.2 Distribution restructuring: the 'REDs' scenario

The financial and technical problems being experienced by many municipal distributors and the subsequent refusal of the NER to grant them permanent licenses has set the stage for the restructuring of the EDI.[6] However, the debate as to the desired outcome of the restructuring process has been hotly contested, with the result that progress is only now being made despite the problems being identified a number of years ago. After considering the input of various forums, working groups and committees, the government set out its vision for the restructuring the EDI in the 1998 White Paper on Energy Policy. Since then this vision has been further debated and refined. Current indications are that most outstanding issues, e.g. the extent of municipalities' authority over the distribution industry, have been finalised. The government has also appointed technical advisors to plan the actual process of restructuring. To this end the government has also approved:

> the restructuring of the EDI through the 'EDI Holdings' model as a transitional (interim) institutional mechanism before financially viable, independent regional electricity distributors (REDs) are established. The REDs will be subsidiaries of the EDI Holdings company until independence. The 'EDI Holdings' model requires that the Distribution division of Eskom be separated completely from Eskom and be merged, on the one hand, with municipalities to form a separate national EDI Holdings Company. The EDI Holdings company will be grouped into regional areas that will coincide with the predetermined RED boundaries. On the other hand, the licensed distributors and municipalities in the specific area will also be grouped, according to predetermined RED boundaries. (DME 1999: 6)

Figure 2 outlines the proposed structure of the ESI after the restructuring of the EDI. Obviously, the actual restructuring process will involve a number of interim steps or phases, but these do not need to be discussed in this context (see DME 1999: 6-8). The dotted arrows in the figure indicate linkages in the structure that have either not been settled or about which we do not

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4 There are calculation errors in the table "Overview of Electricity Sales" NER 1998: 12.

5 See, for instance, ERIC (1996); DME (1998) and Barberton (1998).

6 Initially it was hoped that the NER would be able to use the licensing process to consolidate the EDI, but this proved not to be possible. Hence the current restructuring process.

have information. For instance, we do not have any information on the fate of municipal power stations in the restructured environment. Will they be closed down, incorporated into the appropriate REDs, allowed to operate as independent power producers (IPPs) or transferred to Eskom Generation?

It is possible that some generation licenses may be allocated to IPPs as part of the restructuring of the EDI. This would be one way of separating municipal generation and distribution interests so as to allow consolidation of the EDI into REDs. The government may also allow a number of small IPPs (most likely co-generators) to license during the restructuring of the EDI. However, the market into which these IPPs will be selling is likely to be rather restricted, i.e. either their local RED or the national transmission system – acting as a single purchaser. It is unlikely that these IPPs will be allowed to wheel electricity across the transmission grid at this stage in the restructuring process, if for no other reason than the systems required to manage such a market are not in place. Such developments in the electricity generation industry would be in line with proposals set out in the White Paper on Energy Policy, in which the government indicates that 'the entry of multiple players into the generation market will be encouraged ... [i]nitially ... by obliging the national transmission system to publish National Electricity Regulator approved tariffs for the purchase of co-generated and independently generated electricity on the basis of full avoided costs'[7] (DME 1999: 42).

It should also be noted that the number of REDs illustrated in Figure 2 does *not* reflect the actual number to be set up. As far as is known, the government's current position is still that EDI should be consolidated 'into the maximum number of yet to be determined, financially viable and independent regional distributors' (press release by the Minister of Minerals and Energy, 6 March 1997, see also DME 1999: 6). One of the tasks of the technical advisor is to determine the appropriate number of REDs and their exact boundaries (DME 1999: 12). Currently, proposals vary between five and 50 REDs, with between five and ten being most likely.

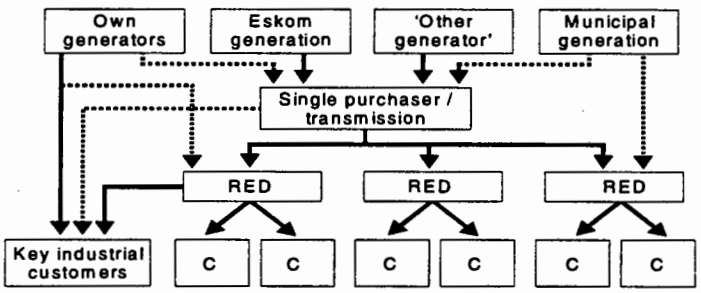

Figure 2: The ESI after distribution has been rationalised: the 'REDs' scenario

Figure 2 shows that in the REDs scenario, the generation industry will continue to be dominated by Eskom Generation. Eskom Transmission will continue to operate the national grid. It is also expected that Eskom Transmission will act as a 'single purchaser' of electricity from Eskom Generation and possibly other generators such as municipal generators and the small number of companies that have 'own generation'. This will introduce a very limited level of competition into the electricity generation industry. Eskom Transmission will on-sell this electricity to REDs for distribution to end-users. It is not yet clear whether certain key industrial customers will be allowed to purchase electricity directly from Eskom Transmission. 'The government's view is that a study is required to develop a set of differential policies and criteria which would allow choice of supply to those industrial customers where this is a critical issue', i.e. impacts on their comparative advantage and profitability. This is something the above-mentioned technical advisors are required to examine (DME 1999: 13).

The restructuring of the EDI is expected to result in the consolidation of existing Eskom Distribution and municipal distribution interests into the 'maximum number of financially viable

[7] For a critique of economic sustainability of this policy see Barberton (2000).

REDs'. As noted above, the exact number of REDs to be set up is still to be determined. REDs will purchase electricity from Eskom Transmission. Whether they will be allowed to purchase it from other sources as well is not yet clear. If they are, it will introduce a measure of wholesale competition into the ESI which would then be developed in the next stage of restructuring (see below).

REDs will have both an exclusive right and an obligation to supply all end-users in the areas under their jurisdiction. Whether this exclusive franchise will include all key industrial customers is not yet clear. If it does not, the key industrial customers are only likely to be allowed to purchase directly from Eskom Transmission and not from other REDs. In other words the 'choice supplier' mentioned is likely to be restricted to a choice between the local RED and Eskom Transmission.

2.3 Introduction of wholesale competition: 'wholesale competition' scenario

Once the REDs are in place, the next logical step in the restructuring process would be to introduce wholesale competition at the generation end of the ESI. Recently it has been suggested that it might not be necessary to wait until the EDI is consolidated before competition is introduced into the wholesale market.

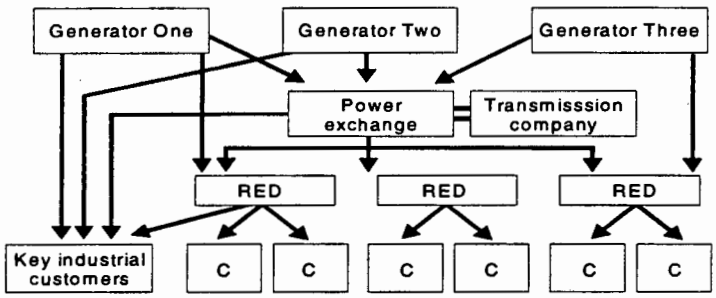

Figure 3: The ESI with wholesale competition: the 'wholesale competition' scenario

As shown in Figure 3, a wholesale market would be one in which a number of generators compete to sell electricity to a power exchange and for the right to supply distributors (the REDs) and key industrial customers. Such a market would be very different from the 'single purchaser market' noted above, in that it would involve generators bidding to sell electricity at competitive prices' – i.e. there would no 'NER approved tariff based on full avoided costs'. In addition, the transmission system would have to be organised to allow for the wheeling of electricity between different generators and their customers.

The generators would be both IPPs from the previous restructuring stage and new entrants to the generation industry. The key question is whether Eskom Generation will remain intact or be broken up into a number of smaller independent companies. If it remains intact, it will be the dominant market player, able to act as a price leader and possibly even use its market power to exclude new entrants. Breaking Eskom Generation up into a number of separate companies will go a long towards creating a more competitive wholesale market.[8] The White Paper on Energy Policy notes that 'for future restructuring, government intends to separate the power stations [of Eskom] into a number of companies' (DME 1999: 44).

The introduction of wholesale competition will require the development of an electricity market or power exchange. Exactly how this market will be organised and how it will set the price of electricity still has to be determined. It is also not clear who will be allowed to participate in the market. Certainly, all generators that meet stipulated technical standards are expected to be allowed to sell into the market. Figure 3 shows that distributors (REDs) and certain key

[8] See Barberton (2000) for a discussion of criteria to guide the decision whether to break Eskom Generation up into a number of smaller companies or to leave it intact.

industrial consumers are likely to be allowed to buy from the market. In addition to buying electricity from the power exchange, the REDs and key industrial customers may be able to contract directly with particular generators for electricity.

The introduction of wholesale competition also requires open access to the transmission grid. To achieve this, it is expected that Eskom Transmission will continue to operate the national grid as a monopoly and all electricity transmitted on the grid will be subject to a regulated 'wheeling charge'. This is confirmed by the White Paper on Energy Policy (DME 1999: 44):

> Government will legislate for transmission lines to provide for non-discriminatory access to uncommitted capacity,[9] transparency of tariffs, and disclosure of cost and pricing information to the National Electricity Regulator.

It is also likely that Eskom Transmission (or its successor company) will operate the power exchange, although there is no reason why it should not be set up as a completely separate business from the transmission business.

The introduction of wholesale competition will not alter relationships between REDs and their customers. The former will still have exclusive franchises to supply particular areas, and the latter will not have any choice of supplier.

2.4 Introduction of retail competition: 'retail competition' scenario

Following international trends the next step after the establishment of wholesale competition would be the phased introduction of retail competition. First, end-users with a maximum demand exceeding, say, 11 MW may be allowed to choose their supplier, then end-users with a maximum demand greater than say 1MW, and so forth, until all end-users have choice of supply. The introduction of retail competition requires the separation of the 'wires' and 'energy' businesses both at the transmission and distribution levels of the ESI. In other words, there would need to be open access to energy retailers (which may be generators or power brokers) to both the transmission grid and all the distribution networks across the country, together with a framework of wheeling charges to ensure fair competition. This will require sophisticated energy management and billing systems to be put in place so as to match energy retailers to their customers and allocate the appropriate wheeling charge.

As shown in Figure 4 the introduction of retail competition will enable end-users of electricity to choose from whom they purchase the 'energy' component of the service. It could be from their local RED, a neighbouring RED or an independent energy retailer such as a generator selling its own electricity or a power broker. The REDs will continue to have regional franchises over the 'wires' components of the service, financed by wheeling charges. This is due to the natural monopoly characteristics of the 'wires' business. REDs may also continue to have an obligation to supply end-users within their franchise areas so as to ensure all customers are serviced. Obviously under full retail competition such a 'franchise obligation' would be lifted. However so long as there are large numbers of customers that do not consume sufficient electricity to cover the operating costs of supplying them such an obligation is likely to remain necessary.

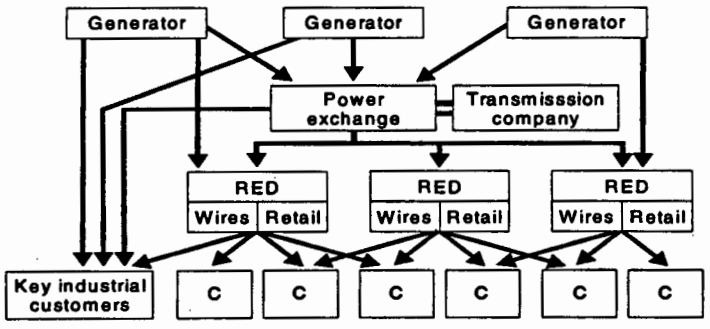

Figure 4: The ESI with retail competition: the 'retail competition' scenario

[9] What is meant by 'uncommitted capacity' is not defined. See Barberton (2000: 33) where it is noted that 'the very existence of such "committed capacity" militates against a competitive market'.

Under retail competition there is likely to be a substantial amount of 'cherry picking', meaning that energy retailers will compete for the best (industrial and commercial) customers rather than the higher risk (domestic) customers. This would tend to place downward pressure on electricity tariffs available to the former customer groups and upward pressure on electricity tariffs offered to the less favoured customers, particularly low-income domestic customers. It would be incumbent on the NER to create a market framework for retail competition that ensures that all customer groups are treated equitably.

3. Restructuring and DSM: Issues to consider

A number of factors need to be considered when examining the likely impact ESI restructuring may have on future investment in DSM. The important point is that restructuring changes the incentives faced by the different stakeholders in the ESI. A utility operating in a monopolistic market structure may have an incentive to invest in DSM because it can capture the benefits of such investments due to the integrated nature of its business. Whereas after restructuring companies operating in competitive electricity markets may not may no longer face the same incentives because the benefits of DSM investments would be dispersed among all players. In some instances, changing the market structure could result in a reversal of incentives, so that instead of a generator seeking ways to get end-users to reduce their use of electricity, it seeks ways to achieve increased demand. This section explores a number of factors that could impact significantly on the incentives stakeholders face to undertake DSM both during the restructuring process itself and in the final restructured environment.

3.1 Importance of the regulator

ESI restructuring entails changing the market structure (and ownership) of the industry, which also implies altering the way in which the industry is regulated. In many instances, a central purpose of restructuring has been to reform the regulatory framework governing the ESI. The approach to regulation can have a significant impact on incentives for DSM since it is central to defining how electricity markets function and the conditions governing participation in such markets. For instance, the regulator may exercise direct control over the price of electricity and structure it in such a way as to include the cost of legitimate DSM expenditures. This will provide utilities with a strong incentive to undertake DSM because they can simply pass the cost on through the price. In contrast, the regulator may create a market where the price of electricity is determined on a competitive basis in which case the dominant incentive will be to minimise costs and increase sales so as to maximise profits. There would, thus, be little incentive to undertake DSM that tends to drive-up costs.[10]

The regulator can seek to encourage DSM in different ways. For instance, it might simply instruct utilities to provide customers with energy audit services. Or it may seek to use market incentives to encourage appropriate behaviour. Such incentives may be built into the pricing mechanism of the market or into the licensing conditions for participation in the market. The important point is that the regulator can either encourage DSM or discourage it.

3.2 Specifying an end-point to restructuring

The choice of end-point to restructuring plays a major role in determining the incentives that stakeholders face with regards to investing in DSM. If the restructuring of the ESI is to end with the establishment of REDs then the incentives faced by, say, Eskom Generation to invest in DSM are likely to be very different than if restructuring were to proceed to the establishment of wholesale competition or even retail competition. The reason for this is that the extent of control that a generating utility has over the end-users of its electricity tends to diminish as restructuring progresses. As a result, it is not able to capture the 'capacity saving benefits' of any DSM investments it might make. In the more competitive scenarios these benefits would tend to be dissipated among other role-players in the generation industry.

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10 See Clark (1999) for a description of different countries' experiences with DSM.

Another important reason for specifying an end-point to restructuring is that it could facilitate the planning of ongoing investment in DSM. Restructuring usually results in a great deal of uncertainty among stakeholders. This uncertainty usually impacts negatively on investment in DSM, because stakeholders do not know whether they will retain control over the stream of benefits arising from an investment in DSM or whether such benefits will be lost to another role-player due to the changing structure of the market. Therefore, in order to minimise their risks, they tend to defer DSM investments until the market has stabilised.[11] One of the ways of reducing this uncertainty is for government to specify the end-point to restructuring early on in the process. Doing so signals to stakeholders how incentives will be structured in future which enables them to plan DSM investments accordingly.[12] This may reduce the 'wait-and-see' effect that restructuring has on such decisions. Instead, stakeholders would focus their efforts on preparing to compete successfully in the end-point environment rather than spending resources on positioning themselves in a climate of uncertainty. One of the difficulties with specifying an end-point, however, is that the realisation of the desired outcomes of restructuring is uncertain, and further restructuring may be necessary to address perverse outcomes. The experience in England and Wales is a case in point (Clark 1999).

It is also possible that so long as the specified end-point falls short of full retail competition, it will be regarded as a holding position and that further restructuring is inevitable. However, it is difficult to envisage how long a particular 'holding position' may last. Recent experience with the process leading up to the imminent restructuring of the EDI suggests that periods between the successive stages of restructuring may be quite extensive – up to ten years. Indeed, so long as electricity markets are regarded as operating sub-optimally (and the understanding of optimal markets may differ over time), there is likely to be pressure for further restructuring. It could therefore be argued that, in the long-run, restructuring will only end with the establishment of effective competition in the wholesale and retail 'energy' markets, and possibly even in the provision of the 'wires' services in transmission and distribution.

3.3 Different ownership options

Ownership patterns within the ESI are often closely related to market structure. So for instance, a dominant player such as Eskom is invariably publicly owned. It is therefore difficult to separate out the impact that ownership patterns and the associated market structures have on DSM investment. At a general level, it could be argued that public utilities should be more inclined to undertake DSM of a social nature, while privately owned utilities, being more focused on profits, are more likely to invest in DSM that offers a real return to investment, rather than DSM with public good characteristics.

The above argument is based on the assumption that the government is able to exercise greater influence over public utilities than private companies. This ignores the fact that the government can probably exercise greater control over utilities by way of regulation than it can by way of ownership, given that the range of regulatory incentives or sanctions is far greater than the sanctions or incentives associated with ownership. Regulatory incentives could include subsidies, tax benefits, fines, the withdrawal of operating licenses and imprisonment, whereas if the government owns a utility the only way it can influence behaviour is provide the funding to make the change, issue directives or replace the management. The extent of the government influence is even further reduced where public utilities are corporatised in preparation for privatisation. In such a situation there tends to be very limited regulatory/public oversight and no market pressures. Private companies are also generally far more conscious of the need to develop their brand or differentiate their products in order to compete successfully and are, therefore, often more ready to undertake social investments that have positive marketing spin-

[11] Eskom seems to be acting very differently, in that it intends investing R50 million in DSM. As noted in section 4.3 the incentive for doing so seems to be to limit the growth in demand and therefore limit opportunities for competing generators to enter the market.

[12] Specifying the end-point to restructuring implies specifying the broad parameters of the regulatory regime as well. Obviously certain issues such as those relevant to DSM may be regulated independently.

offs. Such investments may include investment in DSM programmes with strong public good characteristics.

International experience suggests that the pressures of the competitive market are forcing electricity retailers to increasingly seek ways to retain customers. One way is to offer 'value-added electricity services' which may include a range of DSM, which involves differentiating their product from other retailers. Also, recent experience in the USA suggests that private companies are taking an increasing interest in energy efficiency DSM (education, information etc) because without it people will not invest in other types of DSM from which they can derive profits. Further, because they want to see such education and training done well they often want to do it themselves, which also limits their customers' interaction with other market players and therefore enhances customer retention.

4. DSM in the different restructuring scenarios

This section examines how the incentives to invest in DSM are likely to change between the different restructuring scenarios identified in section 2, taking into consideration the issues raised in the previous section. This section also draws on Clark and Barberton (1999) which examines the barriers currently inhibiting investment in South Africa.

Since incentives are closely linked to the existence of opportunities and barriers for DSM in each scenario, attention is given to how these may change between scenarios. Attention is also given to the tools/policies available to the government or to stakeholders in the ESI either to take advantage of the opportunities or to overcome the barriers to implementing DSM. It is shown how these differ across the scenarios as well.

The discussion focuses primarily on the incentives for DSM faced by the generation, transmission and distribution sectors of the ESI. The aim is to explore the rationale, strategies and so forth that stakeholders in these different sectors face. Given the range of potential issues, only the more important ones are discussed. For each scenario, a table has been prepared that summarises the rationale for DSM, the most likely DSM strategies, the opportunities and barriers to DSM, and the tools that stakeholders and policymakers are likely to use to promote DSM.

It should be noted that the analysis in this section is based on a particular understanding of the relationships between different stakeholders in the ESI and how they are likely to benefit from DSM initiatives. For example, in the wholesale scenario it is assumed that all generators are completely separate from distributors and that any link between the two is purely contractual, i.e. REDs are not allowed to own their own generation capacity. There may well be differences of opinion regarding these relationships. While it may be possible to clarify some issues by gathering empirical data with reference to the status quo scenario, this is not possible in the case of the future scenarios. It is hoped that putting forward this analysis will encourage debate of the issues and that this will serve to bring greater clarity as to how restructuring is likely to impact on future investments in DSM.

4.1 The 'status quo' scenario

As shown in Figure 1 above, the ESI is currently dominated by Eskom. Until recently, Eskom was operated as an integrated utility, which meant that it would have been able to internalise most of the benefits accruing from any DSM investments it made. For instance, it could have undertaken DSM programmes aimed at increasing energy efficiency, which would have reduced the need for additional generation, transmission and even distribution capacity. The fact that Eskom did not invest much in DSM in the past ten (even fifteen) years can probably be attributed directly to the over-supply of generation capacity, the overall supply-driven approach of the utility, the scepticism about the efficacy of DSM and so forth, rather than uncertainty about who should invest in DSM or who would benefit from it (see Clark and Barberton (1999) for a more detailed discussion).

The recent move towards ring-fencing Eskom's generation, transmission and distribution operations has caused Eskom Distribution to explicitly ask: Who is most likely to benefit from DSM? And, therefore, who should pay for it? Until recently, Eskom Distribution implemented and paid for DSM programmes undertaken by Eskom. On the one hand, Eskom Distribution argues that Eskom Generation should pay for such programmes since it is the major beneficiary as DSM postpones the need to invest in additional generation capacity. On the other, Eskom Generation argues that it should not pay for DSM because (a) it is too far removed from customers, and (b) the Wholesale Electricity Tariff (WET) will provide sufficient incentive to encourage distributors (including Eskom Distribution) to undertake DSM where it is economically viable to do so (Clark and Barberton 1999: 39)

Another important characteristic of the status quo is the relationship between Eskom Distribution and the municipal distributors. As noted above, all municipal distributors currently purchase electricity from Eskom Distribution (although the electricity itself is delivered to them by Eskom Transmission). The various tariffs are structured in such a way that they create a definite incentive for municipalities to invest in load-management DSM in order to minimise the cost of their electricity purchases, while maximising their revenues from on-selling electricity to end-users.[13] Clark and Barberton (1999: 12-15) note a range of strategies that municipalities use to shift load, including time-of-use tariffs, load limited tariffs, load factor correction, ripple control on domestic geysers and pumped storage. The incentive to invest in these strategies is overwhelmingly financial. Municipalities are able to internalise much of the benefits because they have a monopoly within the areas under their jurisdiction.[14]

Both Eskom Distribution and municipalities have a direct revenue interest in maximising electricity sales. They, therefore, generally have little financial incentive to undertake energy-efficiency DSM. In fact, both Eskom and municipalities have at different times undertaken programmes specifically to encourage greater electricity consumption. In some instances, this has entailed fuel substitution, which is arguably a more efficient use of resources, but more often the aim has simply been to increase sales and, hence, increase revenues.[15] In the case of Eskom, the need to increase sales has been driven by, among other things, the existence of excess generation capacity (and the need to pay the capital costs associated with building this capacity), by the need to pay for electrification, and the desire to become financially independent of government. Municipalities have also sought to increase sales, (a) so as to increase their surplus from electricity trading – which they use to subsidise the provision of other services, and (b) in order to pay for electrification.

Since 1992 Eskom and municipalities have joined forces in the *ElectroWise campaign*[16] 'to positively influence consumption levels of newly electrified households' and thus contribute to the bottom line of both Eskom and the municipalities. This campaign has sought to address the problem that newly electrified households do not consume enough electricity to generate the revenue needed to cover the running costs, depreciation and interest associated with the distribution grids that service them.[17]

The revenue incentive driving both Eskom and municipalities is a significant obstacle to the implementation of energy efficiency DSM. If such DSM were successful, electricity sales would decline and thus revenues would fall. This would reflect badly on Eskom Distribution's performance in terms of the key performance indicators (KPIs) Eskom uses to evaluate its different divisions. Indeed, in 1998 there was a decrease in electricity sales compared to 1997.

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13 See Clark and Barberton (1999: 10-11) for further details.

14 Durban Municipality, however, argued that if it installed ripple control on geysers Eskom Generation would be the major beneficiary rather than the municipality (Clark and Barberton 1999: 14).

15 The 'white goods' programmes for newly electrified households, the replacement of coal boilers in hospitals and prisons, and the installation of duel-fuel boilers in various different industries are examples (Clarke and Barberton 1999).

16 For a more detailed description of this campaign see Clark and Barberton (1999: 31).

17 In 1997 Eskom reported that "although the average monthly sales to prepayment customers have increased during 1997, this remains significantly lower than the mount required to break even and subsequently generate positive returns (Eskom 1997: 43)

Consequently, in 1999 one of Eskom Distribution's top priorities was to increase electricity sales, which conflicts directly with its DSM responsibilities. As a result the prospects for DSM in Eskom are not good (Clark and Barberton 1999: 36-38).

For municipalities a fall in the surplus they generate from their electricity trading activities would force them to charge more for other services or increase property taxes. Since neither option is likely to be politically acceptable, energy efficiency DSM is likely to continue to be neglected (Clark and Barberton 1999: 19).

As it is in the current environment, many municipalities are holding back on investing in any form of DSM, given the uncertainty around the future ownership of REDs. They are not willing to invest in DSM or, for that matter, in electricity infrastructure generally because they fear losing out should they not be given a proportionate ownership stake in the REDs. In other words, they fear that any new investments in the electricity sector (whether it is on infrastructure or on improved servicing) may be lost to the REDs without them being adequately compensated either for the capital outlay or for the revenue stream that that outlay may have generated (Clark and Barberton 1999: 22). At a more general level, municipalities are less likely to invest in DSM measures, as the political demand for investment in other more 'visible' areas such as the provision of roads, sewerage systems and so forth is far stronger (Clark and Barberton 1999: 22).

Table 1 summarises the points made above, as well as a number of other issues relevant to DSM in the 'status quo' scenario.

DSM from different stakeholders' perspectives		
Generation	***Transmission***	***Distribution***
	Rationale for DSM	
Save building new generation capacity	Save on upgrading transmission networks	Save on upgrading distribution networks
Optimise the use of existing generation capacity		Public relations/marketing
Public relations/ marketing		Reduce peak demand to save on energy bill with Eskom
	DSM strategy	
Reduce system peak demand	Reduce peak/overall demand on specific sections of the transmission network	Reduce peak/overall demand on specific sections of the distribution network
Reduce overall demand	Area and time specific interventions	Area and time specific interventions
Encourage off-peak demand	Foster efficient energy use	Manage load profile
Foster efficient energy use		
	Opportunities for DSM	
Can internalise all benefits of DSM spending due to integrated structure of Eskom	Can internalise all benefits of DSM spending due to integrated structure of Eskom	Distribution monopoly allows benefits of DSM to be internalised
Tariff system based on 'cost-recovery'		Tariffs are based on cost plus system, which means they can accommodate DSM expenditures
No price competition, so reducing costs is not an over-riding consideration		No price competition, so reducing costs is not an over-riding consideration
		No choice of supplier
	Barriers to DSM	
Uncertainty in the EGI	Excess transmission capacity	Uncertainty about future structure of EDI
Low generation costs	Supply-side orientation	Revenue interest
Excess generation capacity	No appreciation of DSM benefits	Supply-side orientation
Supply-side orientation	DSM is perceived to be risky	Lack of finance
No appreciation of DSM benefits	Limited personnel capacity	Limited personnel capacity
DSM is perceived to be risky	Lack of contracting framework	National and local demand profiles differ
Limited personnel capacity	Too many distributors to contract with	No bulk time-of-use tariff
Lack of contracting framework	Customer resistance	Small size of distributors
Customer resistance		Customer resistance

Tools to realise DSM		
Internal:	*Internal:*	*Internal:*
Management directives	Management directives	Management directives
Internal cost signals	Internal cost signals	Internal cost signals
Allow cost recovery in bulk tariff	Allow cost recovery in transmission tariff	Allow cost recovery in distribution tariffs
External:	*External:*	*External:*
Information and education	Information and education	Information and education
Tariff structure	Tariff structure	Tariff structure
Facilitate and provide finance for DSM	Provide finance for DSM	Provide finance for DSM
Contract with customers to implement DSM	Contract with customers to implement DSM	Contract with customers to implement DSM
Appliance supplier co-ordination and appliance labelling		

Table 1: DSM in the 'status quo' scenario

4.2 The 'REDs' scenario

As noted in section 2.2, it would seem that the groundwork for the restructuring of the EDI is at last approaching completion, and that the actual restructuring is imminent. The consolidation of Eskom Distribution and the municipal distribution undertakings into REDs will go a long way to removing the current uncertainty in the EDI, i.e. the institutional structures of the EDI will be established and the rules of the 'new game' will become known. The newly established REDs are likely to seek to consolidate their financial positions by investing in a range of measures aimed at increasing revenues. One of the areas they are likely to focus on is DSM aimed at improving load management and encouraging strategic growth in demand. An analysis of the different barriers identified by Clark and Barberton (1999: 18-22) suggests that many of the barriers currently inhibiting DSM investment by municipalities will be removed with the establishment of REDs. This can be illustrated in three areas:

- The uncertainty prior to the EDI restructuring process has led municipalities to under-invest in load-management DSM, with the result that there has been a build-up of investment opportunities. REDs are likely to be operating in a more certain environment and so will be able to take advantage of these opportunities.
- The REDs are likely to be in a better position to evaluate the financial viability of DSM investments and, given REDs narrower focus on electricity, will face fewer competing priorities than was the case when distribution was a municipal responsibility. As a result REDs are more likely to invest in load management DSM than were municipalities.
- The REDs will have access to the DSM expertise of Eskom Distribution and will therefore be better positioned to undertake DSM than were most municipalities.
- The REDs are likely to be in a better position to raise the necessary finance to invest in load-management DSM than were municipalities.

As regards the last point, REDs are likely to be financially far stronger than the sum of existing Eskom and municipal distributors, for at least two reasons. Firstly, they are likely to be able to realise significant scale economies in both their wires and energy retail operations, which will result in operational cost savings. Secondly, they will not be required to subsidise the provision of other municipal services directly.[18] The improved financial position of the distribution industry as a whole is likely to free funds for investment in DSM measures that offer positive

[18] The technical advisor on the EDI restructuring is required to advise on all aspects of the proposed levy (DME 1999: 12). However, the municipal levy is unlikely to impact much on the financial position of REDs, as it is likely (if implemented) to take the form of an excise tax paid by end-users, with the REDs merely collecting it.

financial returns over the medium-to-long term.[19] This is likely to exclude energy-efficiency DSM because of the impact it will have on electricity sales and therefore revenue. The fact that REDs will have regional franchises will further strengthen the incentive to invest in DSM other than energy efficiency, as they will be able to internalise much of the benefits arising from such investments. The REDs would benefit from better management of their demand profile vis-à-vis Eskom Generation or through managing the timing of expenditure on upgrading distribution networks.[20]

The restructuring of the EDI is likely to be accompanied by the introduction of both a cost-reflective wholesale time-of-use tariff (the Wholesale Electricity Tariff (WET)) between Eskom Generation (which operates an internal national power pool) and REDs.[21] The WET tariff is likely to provide added impetus for REDs to invest in interruptibility, load-shifting and strategic-growth DSM because of the price incentives it puts in place. Other things being equal, there does not appear to be any reason why the WET tariff should encourage REDs to invest in energy-efficiency DSM, which would tend to impact negatively on their revenues. However, if the REDs give their customers the option of moving to time-of-use tariffs (i.e. the WET tariff is passed on to end-users) they may begin to demand energy efficiency services. REDs may choose to supply such services either as part of a marketing package aimed at branding their 'product'/'service' or as a separate enterprise such as an ESCO.

The creation of the REDs will further break up the vertically integrated nature of Eskom. Distribution will be operated by completely separate entities from transmission and generation. However, this does not mean that both transmission and generation cannot benefit from DSM measures implemented by REDs. By its very definition, DSM would have to be implemented by REDs since they interface with customers. But benefits such as reducing the need to upgrade transmission networks or postpone the need to build generating capacity would still accrue to transmission and generation respectively. This may cause the REDs to seek ways to explicitly pass on the costs of DSM to both the transmission and generation utilities.

The introduction of a single purchaser (independent of Eskom Generation) is likely to cause a measure of uncertainty in generation, as it will be seen as the first step towards the introduction of wholesale competition. Even though Eskom Generation will probably remain intact for some time, there are likely be pressures from within the utility to begin positioning its constituent parts for increased competition. Indeed, generators are being clustered together into operational units in preparation for the creation of a number of separate companies in line with the policy set out in the White Paper on Energy Policy (1999: 44). Each of these units would compete against the others. Consequently, individual unit managers would be hesitant to make any DSM investments given that the benefits (such as the reduced need for new generation capacity) would take on 'common good' characteristics and not accrue to the individual unit. International experience also suggests that when utilities are preparing for privatisation they cut back on what they perceive to be 'non-essential' expenditures, which includes expenditure on DSM, particularly energy-efficiency DSM (Clark, 1999).

Another consequence of the creation of REDS is that it significantly reduces the number of distributors that Eskom Generation and Eskom Transmission would have to contract in order to get implemented those DSM measures that they want. Say Eskom Transmission wishes to initiate investment in a range of DSM measures aimed at reducing the growth in demand on a particular transmission line with a view to postponing the date of investing in upgrading the line. In the status quo scenario it would probably need to contract with twenty – even fifty –

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19 Currently most municipalities are so short of funds that they simply cannot consider the initial cost of DSM even though it offers positive returns over the medium-to-long term. Many do not even have the funds to cover operating expenses.

20 When end-users' demand on a given network exceeds its capacity the distributor has to upgrade the network. The distributor may be able to postpone making this potentially large investment by investing a far lessor amount in both load management and energy-efficiency DSM.

21 It has not been clarified whether a 'single purchaser' independent of Eskom Generation will be established to buy electricity from generators and on-sell it to distributors. The White Paper on Energy policy commits the government to initiating a comprehensive study on future market structures (DME 1999: 43).

municipal distributors to make the required investment. In the REDs scenario it would in all likelihood only have to contract with one RED to achieve the same outcome. This is likely to reduce the transaction costs of such contracts very significantly. The fact that there will be far fewer distributors may facilitate the conclusion of contracts aimed at getting the REDs to implement specific DSM programmes on behalf of, and paid for by, Eskom Transmission or Eskom Generation. However, it is doubtful whether Eskom Transmission and Eskom Generation would come forward with proposed investments of this nature, given the other barriers noted above.

An unknown variable in this discussion is what the regulator may require of ESI role-players with regards to DSM investment in the REDs scenario. The regulator may adopt a hands-off approach and allow industry players to respond to initiatives such as the WET tariff. The result of such a policy is likely to be that: (a) REDs will make some investments in interruptibility, load shifting and strategic growth DSM; (b) Transmission will only invest in DSM where there is a direct benefit such postponing the upgrading of a transmission line; and (c) generators will not invest in DSM at all. On the other hand the regulator may seek to provide some 'regulatory encouragement' to ESI role-players to ensure that the public good element of DSM investments (especially energy efficiency) is not forgone. This may be done in a variety of ways and largely depends on the regulatory approach the regulator adopts. The regulator may include specific conditions relating to DSM in the licenses it issues. It may structure prices so as to allow utilities to recover DSM expenditures, or only their lost revenue. Another option would be to place a minimal levy on each unit of electricity sold to pay for DSM, particularly energy efficiency DSM.

Table 2 summarises the points made above, as well as a number of other issues relevant to DSM in the REDs scenario.

DSM from different stakeholders' perspectives		
Generation	***Transmission***	***Distribution***
	Rationale for DSM	
Save building new generation capacity Optimise the use of existing generation capacity Public relations/marketing	Save on upgrading transmission networks	Save on upgrading distribution networks Public relations/marketing Reduce peak demand to save on energy bill Greater emphasis on cost management
	DSM strategy	
Reduce system peak demand Reduce overall demand Encourage off-peak demand Foster efficient energy use	Reduce peak/overall demand on specific sections of the transmission network Area and time specific interventions Foster efficient energy use	Reduce peak/overall demand on specific sections of the distribution network Area and time specific interventions Manage load profile
	Opportunities for DSM	
Can internalise most benefits of DSM spending due dominant position of Eskom Generation Tariff system based on 'cost-recovery' No price competition	Fewer distributors to contract with Can internalise most benefits of DSM spending due to monopoly position	Certainty in structure of EDI Focus on electricity business Distribution monopoly allows most benefits of DSM to be internalised No price competition between distributors No choice of supplier Tariffs based on cost plus system

Barriers to DSM		
Effect of ring-fencing	Excess transmission capacity	Threat of retail competition
Greater uncertainty in the EGI	Supply-side orientation	Uncertainty about cost structure
Low generation costs	No appreciation of DSM benefits	Revenue interest
Excess generation capacity	DSM is perceived to be risky	Supply-side orientation
Supply-side orientation	Limited personnel capacity	National and local demand profiles differ
No appreciation of DSM benefits	Customer resistance	Customer resistance
DSM is perceived to be risky		
Limited personnel capacity		
Customer resistance		
Tools to realise DSM		
Internal:	*Internal:*	*Internal:*
Management directives	Management directives	Management directives
Internal cost signals	Internal cost signals	Internal cost signals
Allow cost recovery in bulk tariff	Allow cost recovery in transmission tariff	Allow cost recovery in distribution tariffs
External:	*External:*	*External:*
Introduction of time-of-use tariffs	Introduction of 'cost-reflective' tariffs	Information and education
Greater scope for contracting with customers to implement DSM	Greater scope for contracting with customers to implement DSM	Tariff structure
Information and education	Information and education	Installation of prepayment meters
Facilitate and provide finance for DSM	Provide finance for DSM	Provide finance for DSM
Appliance supplier co-ordination and appliance labelling		Contract with customers to implement DSM

Table 2: DSM after distribution restructuring: the REDs scenario

4.3 The 'wholesale competition' scenario

Importantly, introducing wholesale competition is unlikely to impact significantly on the incentives for DSM faced by the transmission and distribution sectors of the ESI. It is, however, likely to have a major impact on the incentives faced by utilities in the generation industry. To the extent that generation initiates DSM undertaken by distributors, this change in incentives would impact on the amount of DSM generation 'commission' distribution to undertake on its behalf.

The extent to which the introduction of wholesale competition is likely to impact on DSM investments will partly depend on the competitiveness of the wholesale market. As noted in section 2.3, this will in turn depend on whether Eskom Generation is divided up into a number of smaller independent companies, or left intact. If it is allowed to remain intact, it will be the dominant market player, able to act as a price leader and possibly even use its market power to limit opportunities for new entrants. One of the ways it may seek to discourage new entrants to the generation industry could be to invest heavily in DSM aimed at increasing energy efficiency. This would reduce the demand for additional generation capacity and thus control the potential 'space' in the market for admitting new entrants. Exactly how effective such a strategy would be depends on how much potential there is for 'capacity saving DSM' and the rate of growth in demand for electricity.

Such a course of action may be attractive to Eskom if, as is expected, the government decides that in future additional generation capacity must be built by independent power producers. In effect, Eskom Generation would be competing in the new generation market by investing in reducing the demand for additional capacity. Theoretically, Eskom Generation would continue to make such investments so long as the cost of increasing energy efficiency is less than the perceived cost to itself of admitting a competitor into the market. From an integrated resource planning perspective this may not result in an efficient (i.e. economically optimal) use of resources (it may result in over-investment in energy efficiency!). However, it would be efficient while the cost of such DSM measures is less than the cost of building additional generation capacity. Recently Eskom approved investing R50 million in DSM, which seems to lend some

credence to the above suggestion. Even though this is being done prior to the introduction of wholesale competition the motivation might be the same.

Breaking up Eskom Generation into a number of separate companies will create a more competitive wholesale market, which is likely to cause players in the generation industry to place greater emphasis on cost management in order to be price-competitive. One of the areas likely to be cut is DSM expenditure, given the prevailing supply-side orientation of utility managers and the perception that most DSM, especially energy efficiency, does not offer certain returns. The pressure on DSM expenditures is likely to be greatest where utilities are reliant on selling to a power pool where price is the discriminating factor.

The perception that energy-efficiency DSM does not offer utilities certain returns is likely to be strengthened by the move towards wholesale competition. This can be illustrated as follows: if a generation company contracts a distributor to implement a load-shifting or interruptibility DSM programme aimed at reducing peak demand, the benefits of such an investment would tend to accrue to all players in the generation sector and not only to the generator paying for the investment. This is because the benefit of a lower peak demand would have 'commons good' characteristics such as non-exclusivity. In other words, the generator that made the initial investment would not be able to capture or internalise all the benefits of the investment. Some of the benefits would accrue to other generators as well. As a result, investments in DSM would tend to fall victim to the so-called 'free rider' problem: if some generators invest in DSM all others will benefit. Therefore the rational generator will not invest, in the hope of being able to free-ride on others' investments. However, if all generators act rationally, none of them will invest in DSM, and therefore no benefit will be realised.

One of the ways of getting around the free-rider problem would be for generators to conclude long-term supply contracts with distributors or end-users that are structured in such a way as to enable them to capture the benefits of any DSM investments they might make. For example, the supply contracts that a generator has with large industrial end-users could include interruptible load agreements which allows interruptions only at the discretion of that generator. This would allow the generator to operate closer to its load margin, as it would have the interruptible capacity in reserve. Generally speaking, the pressure on all kinds of DSM is likely to be less pronounced where utilities compete for long-term contracts to supply key industrial customers or REDs. In such instances they may offer certain DSM services (or counter investments)[22] in order to differentiate their particular energy service. Indeed, a situation may even arise where REDs and large industrial customers demand certain levels of DSM investment by generators as part of such long-term supply contracts. The rationale would be that it is in their interest to stabilise their demand for electricity to a level that the generator is able to supply, so that they do not have to purchase additional power from the more expensive electricity pool. From the utility's perspective, it would wish to service all their customers' energy needs so as to avoid losing them to competitors.

Generators selling to a power pool would have no incentive to encourage any form of DSM. If the generating capacity supplying the pool is fixed, as the demand for electricity from the pool increases so the price will rise. Therefore generators intent on maximising profits will want demand to exceed supply consistently. Interruptibility, load-shifting and energy efficiency DSM would tend to moderate demand which would have a negative impact on prices during peaks. However, undertakings such as Eskom Enterprises' Virtual Power Station could play a crucial role in a power pool by offering to sell 'negawatts' during peaks. Such 'negawatts' would be 'generated' by load-shifting and interruptibility DSM managed by the Virtual Power Station. Theoretically it is even possible for a company to sell 'negawatts' to the power pool generated from the implementation of energy-efficiency DSM. However, practically it is difficult to verify and measure the extent of savings resulting from a given energy-efficiency programme. The

[22] For instance, in order to get a long-term supply contract with a RED, the generator may offer to assist finance a ripple-control system on domestic geysers. This would be to the benefit of the RED as it would smooth its demand profile and it would benefit the generator by reducing the amount of peaking capacity it needs in reserve in order to supply the RED. It would also add another dimension to the simple electricity supply contract which would make it more secure.

price the pool would be willing to pay for such negawatts would also be very low, given that they would be comparable to base-load power rather than peaking power.

Again, an unknown variable in this discussion is what the regulator may require of ESI role-players with regards to DSM investment in this scenario. As noted above, if the regulator adopts a hands-off approach, transmission and distribution will only invest in DSM when it makes financial sense to do so, while generation is unlikely to invest in any DSM at all. If, however, the regulator were to seek to provide some 'regulatory encouragement' the different approaches noted previously would still apply.

Table 3 summarises the points made above, as well as a number of other issues relevant to DSM in the 'wholesale competition' scenario.

DSM from different stakeholders' perspectives		
Generation	***Transmission***	***Distribution***
	Rationale for DSM	
Emphasis on cost management and price/ service competition Public relations/marketing	Save on upgrading transmission networks Emphasis on cost management	Save on upgrading distribution networks Public relations/marketing Reduce peak demand to save on energy bill with Eskom Emphasis on cost management
	DSM strategy	
Provide a competitive customer service	Reduce peak/overall demand on specific sections of the transmission network Area and time specific interventions Foster efficient energy use	Reduce peak/overall demand on specific sections of the distribution network Area and time specific interventions Manage load profile
	Opportunities for DSM	
Can contract directly with REDs/customers to realise DSM savings	Fewer distributors to contract with Can internalise most benefits of DSM spending due to monopoly position	Certainty in structure of EDI Focus on electricity business Distribution monopoly allows benefits of DSM to be internalised No price competition between distributors No choice of supplier Tariffs are based on cost plus system
	Barriers to DSM	
The competitive market structure DSM becomes a 'commons good' (free rider problem) Low generation costs Excess generation capacity Supply-side orientation No appreciation of DSM benefits DSM is perceived to be risky Limited personnel capacity Customer resistance	Excess transmission capacity Supply-side orientation No appreciation of DSM benefits DSM is perceived to be risky Limited personnel capacity Customer resistance	Threat of retail competition Revenue interest Supply-side orientation National and local demand profiles differ Customer resistance

Tools to realise DSM		
Internal:	*Internal:*	*Internal:*
Management directives	Management directives	Management directives
External:	Internal cost signals	Internal cost signals
Time-of-use tariffs	Allow cost recovery in transmission tariff	Allow cost recovery in distribution tariffs
Use long term contracts with customers to capture benefits of DSM	*External:*	*External:*
	'Cost-reflective' tariffs	Information and education
	Greater scope for contracting with customers to implement DSM	Tariff structure
	Information and education	Installation of prepayment meters
	Provide finance for DSM	Provide finance for DSM
		Contract with customers to implement DSM

Table 3: DSM after generation restructuring: the 'wholesale competition' scenario

4.4 The 'retail competition' scenario

While the introduction of wholesale competition is likely to impact on how generators regard DSM, the move towards retail competition is likely to bring about significant changes in incentives for DSM at the distribution and retail end of the ESI. The introduction of competition for generation services at the retail level is likely to leave the incentives for DSM for both generation and transmission largely unchanged relative to the previous scenario.

As noted in section 2.4, the introduction of retail competition requires the separation of the 'wires' and 'energy' businesses at the distribution level of the ESI. The 'wires' businesses would continue to function as regional franchises connecting all end-users within their areas to the distribution network, because of the natural monopoly characteristics of the 'wires business'. The 'energy' or retail businesses would then compete to sell electricity to the end-users and pay the wires businesses a wheeling charge for taking the electricity to their customers. This separation of the 'wires' and 'energy' businesses is likely to cause significant changes in the structure of incentives for DSM at the distribution level.

In each of the previous scenarios, REDs provided integrated wires and energy services to customers. Consequently, on the one hand they had a revenue interest in increasing electricity sales and, on the other hand, an incentive to encourage energy efficiency in order to save on investments in upgrading their distribution networks. Given the perception that returns to DSM investments (other than ripple control) are uncertain, it is expected that REDs will seek to maximise their revenue from electricity sales, and only in exceptional circumstances invest in other types of DSM with a view to postponing network upgrades. However, separating the wires and energy businesses is likely to clarify the respective businesses' interests with regard to the different types of DSM. It is expected that the 'wires' businesses will become far more proactive in the use of all the different types of DSM to maximise the return on their existing network investments. In other words, such 'wires' businesses are more likely to see investment in DSM (load management and energy efficiency) as a means of postponing the need to invest in upgrading a particular distribution network. They are also likely to be in a better position to evaluate the costs and benefits of such options given that their narrower focus on the 'wires' business. In some instances, the 'wires businesses' may be able to contract directly with end-users to implement particular DSM measures, such as ripple control devices on geysers to reduce peak demand on a particular distribution network. In other instances, the 'wires' businesses may have to contract 'energy' businesses operating in their areas to implement, say, an interruptibility DSM programme. This may entail agreeing to compensate the energy business for some proportion of lost revenue resulting from the implementation of the DSM programme. A third option would be for the 'wires' business to contract an independent energy service company (ESCO) or perhaps even an NGO to supply a given DSM service, in all likelihood energy efficiency DSM. This would eliminate the conflict of interests and the need to compensate for lost revenues as a result of contracting an 'energy' business.

At a superficial level, it may seem that the new 'energy' businesses will have little incentive to undertake any form of DSM that reduces energy sales, most notably energy efficiency. This is based on the assumption that their interests are best served by maximising electricity sales.

Managers of 'energy' retailers that hold this view will see little reason to invest in DSM. A focus on price competition is also likely to reduce the incentive for DSM investments, as there would be reduced scope for individual retailers to recover the costs of DSM expenditures through their prices as this would tend to undermine their competitiveness.

It is possible that, as the retail market matures, certain 'energy' retailers will seek to differentiate their product by offering their customers 'more than just electricity'. This could take the form of an integrated package of energy services, including advice on load management and energy efficiency, as well as complementary services such energy audits. In other words, the energy retailers would begin to seek to offer competitive energy services, rather than competing only with regard to the price of electricity. Offering such services may also be crucial to getting customers to agree to longer-term contracts, which would be key to enabling energy businesses efforts to stabilise their revenue base.

Retail competition also means that end-users will be able to choose their supplier. For the vast majority of end-users the price of electricity is likely to be the most important variable in determining from whom they choose to purchase their electricity. However, as end-users become more environmentally sensitive, some may begin to seek an integrated energy service that includes DSM services. This would represent the demand side for product differentiation in the energy retail market.

Table 4 summarises the points made above, as well as a number of other issues relevant to DSM in the retail scenario.

DSM from different stakeholders perspectives		
Generation	***Transmission***	***Distribution***
	Rationale for DSM	
Emphasis on cost management and price/ service competition	Save on upgrading transmission networks Emphasis on cost management	Emphasis on cost management and price/ service competition
	DSM strategy	
Provide a competitive customer service	Reduce peak/overall demand on specific sections of the transmission network Area and time specific interventions Foster efficient energy use	Provide a competitive customer service
	Opportunities for DSM	
Can contract directly with REDs/customers to realise DSM savings	Fewer distributors to contract with	Focus on electricity business
	Barriers to DSM	
The competitive market structure DSM becomes a 'commons good' (free rider problem) Low generation costs Excess generation capacity Supply-side orientation No appreciation of DSM benefits DSM is perceived to be risky Limited personnel capacity Customer resistance	Excess transmission capacity Supply-side orientation No appreciation of DSM benefits DSM is perceived to be risky Limited personnel capacity Customer resistance	Customers can change supplier Uncertainty due to separation of 'wires' and 'energy' businesses Revenue interest Supply-side orientation National and local demand profiles differ Customer resistance

Tools to realise DSM		
Internal:	*Internal:*	*Internal:*
Management directives	Management directives	Management directives
External:	Internal cost signals	*External:*
Time-of-use tariffs	Allow cost recovery in transmission tariff	Contract with customers to implement DSM
Greater scope for contracting with customers to implement DSM	*External:*	
	'Cost-reflective' tariffs	
	Greater scope for contracting with customers to implement DSM	
	Information and education	
	Provide finance for DSM	

Table 4: DSM in the retail competition scenario

5. Restructuring and DSM: an overview of trends

The preceding sections suggest that ESI restructuring may continue through to the introduction of full retail competition. However, the process of restructuring is unlikely to be continuous. As noted in section 3.2, the time periods between the successive phases of restructuring may be quite extensive – up to ten years. This is ample time for stakeholders to adapt to each new environment and take advantage of the opportunities they afford. It may therefore be somewhat misleading to frame this discussion in terms of 'trends', since, while the process of change may be rapid at the time of restructuring from one scenario to the next, things might be quite stable in the interim periods. With this *caveat* in mind, this section looks at a number of key changes associated with restructuring across the different scenarios discussed in section 4 and how these are likely to impact on incentives to investment in DSM.

5.1 Movement away from an integrated industry structure

Each of the scenarios identified in section 4 represent a step away from an integrated industry structure. In the status quo scenario, Eskom is in the process of ring-fencing and clustering its various operations. This, to a large degree, serves to define each division's interests in DSM more clearly. However, while the divisions may operate independently, they still report to the same executive management and board which are able to integrate their different interests to serve the interests of the whole of Eskom. Obviously, as the process of ring-fencing progresses, each division will define its own interests more clearly. In the REDs scenario, the distribution sector is consolidated into a number of independent companies, and an arms-length relationship is introduced between generation and transmission by means of the single purchaser mechanism. In the wholesale competition scenario, the 'energy' and 'wires' businesses are separated from each other at the transmission level. To achieve this a power pool and independent system operator need to be established, wheeling charges for transmission introduced, and generators given the right to contract directly with large end-users and distributors. Finally, in the retail competition scenario the 'energy' and 'wires' businesses are separated out from each other at the distribution level.

The process of moving away from an integrated industry structure is likely to impact on DSM investment in at least three ways. Firstly, breaking the ESI up into its constituent parts tends to clarify different stakeholders' interests in DSM. As noted above, 'wires' and 'energy' businesses face very different incentives when it comes to evaluating investments in different types of DSM. Where these businesses are undertaken by a single undertaking, such as a RED, there is likely to be a lack of clarity as to what DSM measures are in its interests. For instance it may be rational from a 'wires' business point of view to invest in energy efficiency DSM in order to postpone the need for a network upgrade. This would, however, impact negatively on the revenues of the 'energy' business side of the RED. The RED would thus have to evaluate what makes overall financial sense. The process of balancing revenue impacts against other potential

benefits is likely to perpetuate the perception that energy efficiency DSM does not offer a RED any clear-cut benefits.

Secondly, and in contrast to the above point, the move away from an integrated industry structure is likely to make it more difficult for the utility or company making the DSM investment to capture and internalise all the benefits. For instance, DSM investments at the distribution level may hold benefits for the distributor, as well as transmission and generation. A vertically integrated electricity utility would be able to capture and internalise all these benefits. In contrast, in a non-integrated industry these benefits would accrue to a number of companies other than the company that made the original DSM investment. As a consequence, certain DSM investments may offer better returns in an integrated industry structure than in a non-integrated environment. This point can also be illustrated with reference to the generation sector. If there is a single generating utility it is able to make the trade-off between the cost of building new generating capacity and the cost of capacity-saving DSM measures (such as load-shifting, interruptibility and energy efficiency). Should demand increase it may decide to invest in DSM instead of build new capacity. However, where there are a number of generating companies the benefits from DSM investments aimed at reducing the demand for new generating capacity would have 'commons goods' characteristics. No single company would be able to capture the benefit. Some companies may even see such investments as a lost opportunity to expand their own capacity and therefore their share of the generation market.

Thirdly, the movement away from an integrated industry structure tends to result in a clear distinction being drawn between DSM that is financially viable and DSM that is predominantly a public good. This is because the various companies that emerge from the restructuring process are likely to be far more focused on realising acceptable returns on investments than a large, integrated, monopolistic utility. Whereas the latter might invest in a wide range of DSM measures (as part of its contribution to the public good), the former are likely to be far more discriminating and only invest in those DSM measures that offer the utility positive financial benefits. Consequently, utility investment in DSM of a public good nature is likely to decline as restructuring progresses, unless the government (probably acting through the regulator) takes measures to counteract the trend (see section 5.4).

5.2 Separation of wires and energy businesses

As noted in section 4, the 'wires' and 'energy' businesses are separated out from each other in two stages: first in the wholesale competition scenario the bulk energy business is separated from the transmission 'wires' business. Second, with the introduction of retail competition the distribution 'wires' businesses would be separated from energy retail businesses. In addition to the points noted in the preceding section, the establishment of separate 'wires' and 'energy' businesses is likely to impact on DSM in the following ways: firstly, it removes from the equation the revenue incentive associated with electricity sales when a 'wires' business comes to evaluating whether to implement a DSM programme in order to avoid a network upgrade (see section 4.4).

Secondly, it enables the 'wires' businesses to focus exclusively on maximising returns on their investments. This is likely to entail moving away from the supply-side approach that has tended to dominate the provision of transmission and distribution infrastructure to date. Instead, 'wires' businesses are likely to focus on finding the most economical way of ensuring their customers have access to the electricity services they require. This may involve investing in DSM measures in order to reduce peak demand growth and thus extend the useful life of existing infrastructure, as opposed to simply allowing the growth in demand to dictate when a particular line had to be upgraded.

Thirdly, it creates an environment in which energy services can develop beyond offering customers more than just electricity. As noted in sections 4.3 and 4.4, companies in the 'energy' business (both generators and energy retailers) will begin to seek ways to differentiate their product, and this may lead them to offer an integrated package of energy services that could include certain DSM measures or 'counter investments'. Some of these measure may amount to little more than marketing aimed at attracting and retaining customers, but the possibility

exists that they could be developed further into separate revenue generating services that the 'energy' business can offer to clients.

5.3 Impact of competitive electricity pricing on DSM

A key objective of nearly all restructuring processes is to move the ESI towards greater reliance on markets for determining the price of electricity. In the above scenarios, this is reflected first by the introduction of a single purchaser, then wholesale competition and, finally, retail competition. Looking at the impact that this move towards competitive electricity pricing is likely to have on DSM, the following points come to the fore:

- Firstly, 'energy' businesses will tend to focus on managing-down costs in order to be able to price their electricity competitively. This will inevitably mean cutting back on non-essential expenditures. Many of these 'energy' businesses may regard DSM as a non-essential expenditure and therefore eliminate it completely, or only maintain a token amount for marketing purposes.
- Secondly, in a non-competitive market structure, utilities are often allowed to use their tariffs or other chargers to recover reasonable costs incurred in the course making DSM and other 'public good' investments. However, in a competitive market the process for determining the price of electricity often does not lend itself to recovering such expenditures. Companies are therefore less likely to make such expenditures given that they will not be able to recover them in the normal course of their activities. This will tend to discourage expenditure on DSM. One way of overcoming this obstacle would be for the government to institute a levy on all electricity sales to finance DSM programmes with a strong public good content. This would be a system-wide distribution charge (per kWh usage or per account) levied on all customers. Alternatively, the regulator may seek to structure tariffs so as to allow companies to recover costs incurred as a result of DSM investments. However, mechanisms to recover costs are unlikely to be effective where energy businesses are very price-competitive. This is likely to be especially true with retail competition. A retailer would not want to recover expenditures and lost revenues from DSM investments because it would increase its price above competitors' prices. Consequently the retailer would simply prefer not to invest in DSM.
- Thirdly, it is often argued that determining electricity prices in a competitive market will place downward pressure on electricity prices (DME 1998: 43). Should this happen it will tend to encourage end-users to consume more electricity, and thus reduce the financial incentive to invest in energy efficiency. This may not be a desirable outcome when viewed from an integrated resource management perspective.

However, when competition in the wholesale and retail energy markets is examined more holistically, competitive electricity prices are likely to be an important, but by no means an over-riding factor. As the market for energy matures and customers become more discerning, companies are likely to seek ways to differentiate their services in order to attract and retain customers. A move in this direction will offer exciting opportunities for the development of DSM, including the development of integrated energy service packages, the conclusion of long-term contracts that allow energy companies to internalise the benefits of DSM investments and the development of energy services as a separate revenue earning activity. This latter development could even result in the establishment of energy service companies (ESCOs) that focus on DSM measures that can generate positive returns on investments.

It should be also be noted that while the 'energy' side of the electricity industry is likely to be exposed to competitive pricing, wheeling charges on the 'wires' side of the electricity industry will continue to be regulated. This means that many of the pressures noted above will not apply to these charges. There does not appear to be any reason why 'wires' businesses in the transmission and distribution industries should not be allowed to recover reasonably incurred DSM expenditures through wheeling charges.

5.4 Energy efficiency DSM becomes a 'commons good'

In the discussion of the wholesale scenario in section 4.3, it was noted that the emergence of a number of generating companies resulted in the benefits from DSM investments taking on 'commons good' characteristics. As certain interruptibility, load-shifting and energy efficiency DSM measures take on the 'commons good' characteristic of non-exclusivity, investment in these measures is likely to fall. The reason for this is that, when a company assesses the returns on such a DSM investment, it will realise that it is unlikely to capture sufficient of the benefit to make the investment worthwhile, since the benefit will be spread across other players in the industry. With this information, the rational company is likely to adopt a free-rider position. In other words, rather than making the investment itself, it will hope to derive benefit from others making such investments. If all companies act rationally, the consequence will be that little or no investment will actually take place.

There are a number of ways in which industry players can seek to overcome this 'commons good' problem. It has been noted above that generators may seek to 'capture' the benefits by concluding long-term contracts with the end-users in which they would be making the DSM investment. This could be regarded as a private market solution to the problem. Another approach could be to get all the industry players together and to conclude an industry-wide agreement, binding all parties to making certain minimum investments in particular DSM measures. This would significantly reduce the information gap associated with the free-rider problem, but it would not completely eliminate the risk of certain companies seeking to free-ride the agreement. It would therefore require some form of monitoring system to be put in place to ensure that all companies keep to the terms of the agreement. A third approach would be for the government to address the market failure in some way. For instance, it could set up an autonomous agency to oversee the implementation of DSM. This agency could be funded either from the fiscus or by a levy on energy sales. Another option would be to make it a condition of generators' and energy retailers' trading licenses that they undertake certain DSM investments. This would still require some form of monitoring to ensure compliance. (See Clark and Mavhungu (2000) for more details on these measures.)

5.5 Investment in DSM with public goods characteristics

As the ESI is restructured, the various stakeholders that emerge from the process will be increasingly focused on managing costs and generating a market-related return on investments. Consequently, if left to themselves, they are only likely to choose to invest in DSM programmes that offer clear financial returns. On the one hand, this can be very beneficial for the implementation of strategic growth, load-shifting and interruptibility DSM, and to a lessor extent energy efficiency DSM. Instead of being considered only as a green issue or a public relations investment, the option to invest in DSM will increasingly be considered in the same light as other investment options. Consequently, where DSM offers good returns, companies will have to seriously consider making such investments, simply to be competitive. It could even lead to a situation where companies begin to offer integrated energy services that include DSM measures as a means of generating income. Ultimately it could lead to the establishment of ESCOs that focus on providing DSM related services.

On the other hand, companies with an over-riding commercial focus are less likely to invest in DSM that has strong public good characteristics, most notably energy efficiency. Indeed, as restructuring progresses, less and less is likely to be invested in encouraging end-users to become more energy-efficient. This is because both generators and energy retailers will have a direct revenue interest in getting end-users to increase their electricity consumption, and 'wires' companies are unlikely to be interested, except where it may postpone the need to upgrade a specific section of the network. Some companies may allocate some funds to energy efficiency for marketing reasons, but in such instances the aim would be to maximise the publicity impact rather than the real impact. Against this background, investment in DSM that has public good characteristics will need to increasingly become an issue to be dealt with at a policy level. To ensure that such DSM takes place, the government would have to decide on appropriate policy with regards to (a) what should be done, (b) how it should be paid for, and (c) who should do

it. Some of the options available to government have already been noted in the preceding section. (See Clark and Mavhungu (2000) for more details on these measures.)

6. Conclusion

6.1 Overview of the main impacts of restructuring on DSM

Table 5 presents an overview of the main impacts that the different scenarios for restructuring the electricity industry are likely to have on DSM.

The main impacts of restructuring on DSM			
Status quo scenario	***REDs scenario***	***Wholesale competition scenario***	***Retail competition scenario***
		Overall impact	
The integrated structure of the utility should foster investment in all types of DSM since the utility as a whole would be able to internalise all the benefits. The supply side orientation of Eskom hinders investment in DSM.	Generation and transmission will have to contract REDs to undertake DSM on their behalf. REDs will be 'freed' to focus on electricity issues and so are likely to invest more in financially viable DSM measures, i.e. mainly load shifting and interuptibility DSM	The break-up of the dominant utility to create a competitive wholesale market will result in the 'capacity saving benefits' of DSM taking on 'commons good' characteristics. As a result investment in all types of DSM is likely to fall, but especially energy efficiency DSM.	The introduction of energy retailers may foster all types of DSM if the market is structured so as to encourage competition on the basis of differentiated energy services rather than simply energy prices.
		Generation	
Generation would tend to be a monopoly and so would be able to internalise all the benefits arising from more efficient use of existing capacity. Low generation costs and the existence of excess capacity have proved to be major obstacles to DSM.	The dominant utility will continue to internalise most of capacity saving benefits of DSM investments The uncertainty caused by the prospect of wholesale competition is likely to make generators hesitant to invest in DSM	Generators' incentives to invest in DSM undermined by DSM becoming a 'commons good'. Generators may seek to capture certain DSM investments by concluding long-term contracts with large consumers.	The incentives for generators to do DSM will still be plagued by the 'commons good' problem. There may be more scope for generators to contract with energy retailers to capture the benefits of load shifting and interuptibility DSM measures.
		Transmission	
Again the integrated structure of the utility allows transmission to benefit directly from DSM measures implemented by Eskom distribution.	The reduced number of distributors will simplify the process of contracting them to implement DSM	The incentives for transmission to undertake DSM will remain much the same, as will the opportunities for contracting with distributors	Incentives remain the same as in previous scenario.
		Distribution	
Cost plus tariffs and revenue interests of distributors can obstruct energy efficiency DSM but facilitate load shifting and interuptibility DSM.	The absence of price competition may facilitate DSM investment by REDs. The revenue interests will discourage investment in energy efficiency DSM.	The threat of retail competition is likely to discourage REDs making further load management DSM investments.	Customers can choose the type of energy service they want. This may encourage retailers to offer services that include the full range of DSM options.

Table 5: The main impacts of restructuring on DSM

6.2 Restructuring to strengthen incentives for DSM

In many senses the analysis in the previous section represents a problem statement. By identifying what is likely to happen to DSM as restructuring progresses, it poses a number of challenges that need to be considered when defining the objectives of restructuring. These challenges can be framed as questions:

- What can be done to ensure that investment in DSM with public good characteristics, most notably energy efficiency, takes place? Where would the funding come from? Who would manage the funds and ensure they are used effectively?
- What can be done to overcome the 'free-rider' problem associated with certain DSM investments taking on the 'commons good' characteristic of non-exclusivity? For instance, how can the separate generating companies be made to invest in DSM aimed at reducing system peaks in demand, rather than simply investing in additional generation capacity?
- How should the mechanism for determining the electricity price at the wholesale level be designed to ensure that the price includes the social cost of electricity use? This would be crucial if the price is to be an accurate signal of the resource cost of electricity consumption, and therefore a signal to end-users encouraging greater energy efficiency.
- How should tariffs be structured so that they provide end-users with accurate information with which to evaluate the potential benefits of investing in energy efficiency and other DSM measures?
- How should wheeling charges be designed to encourage 'wires' businesses to undertake appropriate DSM investments? This is based on the understanding that transmission capacity is a limited resource and needs to be priced as such; thus, when demand for transmission capacity begins to push the boundaries of supply the price should increase.
- How can 'energy' businesses be encouraged to compete with each other on the basis of the energy services they offer customers, rather than simply on the basis of the price of electricity?
- How can 'wires' businesses be encouraged to give explicit consideration to DSM when evaluating the need to upgrade a given transmission or distribution network?
- How can the government facilitate the emergence of ESCOs that provide services with a strong DSM content?

In some instances, the discussion in sections 4 and 5 began to explore options for addressing some of these questions. This process of option analysis and the making of recommendations is the focus of the fourth and fifth report in this project series.

Probably the most crucial area of intervention in ensuring DSM is well placed in the electricity industry contexts is to ensure that the restructuring process is designed in a way so as to foster *incentives* for DSM. Governments only embark on restructuring processes with a view to achieving a number of key objectives. These usually include the establishment of effective competition, the promotion of private sector participation in the ESI, the separation of the 'wires' and 'energy' businesses, the promotion of economic growth, the restructuring of regulatory mechanisms and so forth. It would be a significant step forward, if the government were to identify 'the promotion of DSM' as a key objective of restructuring as well. This would place it alongside the other objectives that the government would take into consideration when designing and implementing the restructuring of the ESI.

Identifying the promotion of DSM as one of key objectives of restructuring the ESI would require that special attention be given to resolving the challenges raised by the above questions. This is likely to entail giving explicit consideration to DSM in the design, planning and implementation of the restructuring process.

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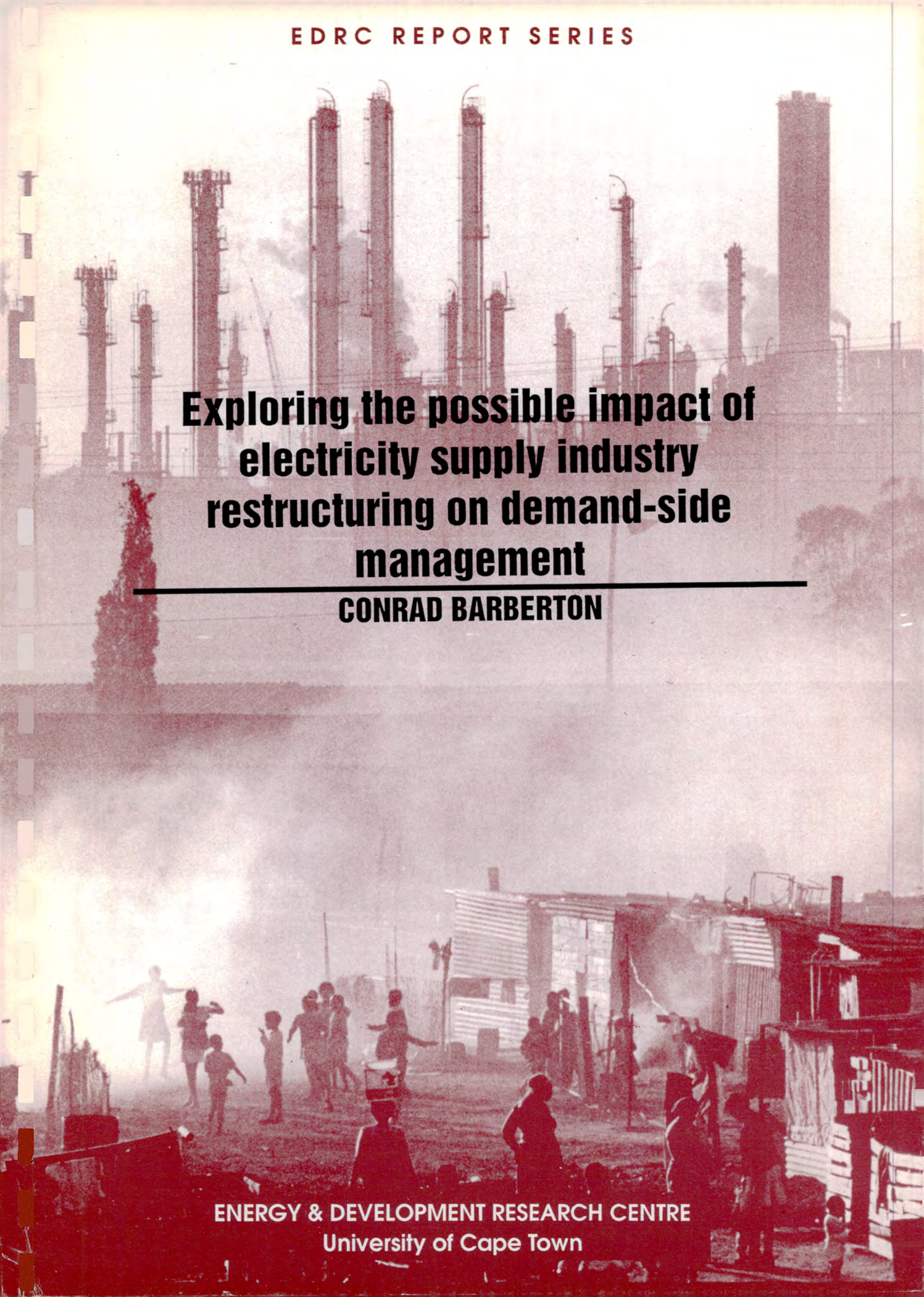

Exploring the possible impact of electricity supply industry restructuring on demand-side management

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