Potential impacts of electricity industry restructuring on renewable energy and energy efficiency

Harald Winkler
Energy and Development Research Centre, University of Cape Town[*]

Justice Mavhungu
Deputy Director (Energy Sector), Department of Public Enterprises

Published as

Winkler, H & Mavhungu, J 2002. Potential impacts of electricity industry restructuring on renewable energy and energy efficiency. *Journal of Energy in Southern Africa* 13 (2): 43 - 49.

See original for page references.

Abstract

The South African electricity industry is on the brink of considerable restructuring. The future of social and environmental public benefits provided in this context is uncertain. This paper focuses on environmental public benefits, such as renewable energy and energy efficiency, which face both opportunities and threats under restructuring.

We conclude that, in the short term, policies and measures that could protect environmental benefits should focus on energy efficiency measures, an energy efficiency institution, power purchase agreements and non-discriminatory access to the grid for renewable independent power producers. In the longer term, the regulator should set a renewable electricity portfolio standard for electricity generation, and require distributors to invest a minimum percentage in energy efficiency. A systems benefit charge is one possible mechanism to finance such measures. These efforts need support from further public-interest research.

Keywords: Renewable energy; energy efficiency; restructuring; power sector reform; environment; electricity supply industry; electricity distribution industry.

Acknowledgement

The article is based on a report prepared by EDRC for the Sustainable Energy and Climate Change Partnership, a project of Earthlife Africa Johannesburg and WWF Denmark. The immediate goal of the project is to support South African civil society, in co-operation with Northern and Southern NGOs, in advancing policies and measures to address climate change and greenhouse gas emissions while maximising the social benefits that will accompany implementation of sustainable energy.

[*] Corresponding author: EDRC, University of Cape Town, Private Bag, Rondebosch 7701; fax: +27 21 650 2830; email: harald@energetic.uct.ac.za.

1. Introduction

The South African electricity industry is on the brink of considerable restructuring, implying changes in ownership, structure and regulation, potentially encompassing both the electricity supply and distribution industries. Eskom, will shortly become a publicly-owned company, and possibly a private company subsequently.

The rationale for restructuring is that it will promote economic and technological efficiency within the electricity sector, delivering notable social benefits. In other countries, however, restructuring has often seen higher prices, particularly for small customers, and loss of public benefits [1]. Although new opportunities may emerge as access to markets is opened up, private companies will not willingly invest in programmes with no commercial return. Change in South Africa renders uncertain the future of electricity-related public benefits, including energy efficiency, renewable energy, environmental protection, public-interest research and development activities, and improved access to energy by the poor.

This article, which is based on a recent EDRC report [2], focuses on the effects of restructuring on *environmental* public benefits – particularly renewable energy and energy efficiency; we then make policy recommendations and suggest potential funding sources.

2. The restructuring process

Power sector reform is driven strongly by international agencies and concerns [3, 4]. The overall lesson from international experience is that competitive electricity markets significantly narrow the spectrum of financially viable energy-efficiency investment, making the public sector's role in protecting social and environmental benefits critical. Regulation to protect public benefit is one of several new forms of regulation that will be required in a restructured industry; others include competition regulation (eg fairness for independent power producers), economic regulation (eg avoiding monopoly pricing) and technical regulation (ensuring standards) [5]. The literature on power sector reform (restructuring) in developing countries is growing, but has tended to focus more on energy efficiency than renewable energy [6] [3] [7] [4] [1].

Some of the factors driving restructuring internationally apply in South Africa: the desire to improve efficiency, potentially widening customer choice; new smaller-scale technologies allowing more participants in the market (gas and renewables); and environmental concerns (including climate change) slowing investment in large power plants. Technical factors are reinforced by a dominant belief in the greater efficiency of private over public capital. Structurally, the local industry could be unbundled both vertically (by separating distribution from generation and transmission) and horizontally (by breaking Eskom's monopoly on generation) [5]. On the supply side, restructuring aims to increase competition, by changing industry structure to include more generators (wholesale competition). While competition is more easily achieved in generation, many argue that transmission and distribution remain natural monopolies [5], as there is only one electricity grid.

Within the supply industry, Eskom, it has been argued elsewhere, is in urgent need of restructuring to improve operational and investment efficiency, to boost economic growth and development and to generate an economic return to shareholders [8]. The utility has already gone through a process of commercialisation, after the Eskom Conversion Act of 2001 turned it into a company with the state as its only shareholder – a process distinct from privatisation (see Figure 1), as ownership is unchanged.

On the demand side, restructuring will consolidate distributors and at a later stage might lead to retail competition. The reasons for restructuring in the electricity distribution industry are different from those for the ESI [6]. A key issue is the lack of financial viability, with many municipalities close to bankruptcy and not paying Eskom for bulk supplies [9]. Another problem is inequitable treatment of customers, with differential tariffs, quality of service and reliability. EDI restructuring would be intended to remove the inefficiencies arising in an industry that is fragmented between 368 distribution businesses and thus loses any economies of scale. The key steps in EDI restructuring are transferring Eskom distribution and municipalities to an EDI Holdings Company, and the formation of six new regional electricity distributors.

Electricity sector restructuring in South Africa is part of a broader government resolve to restructure the four largest state-owned enterprises: Transnet, Telkom, Denel, as well as Eskom. The 1998 White Paper on Energy Policy[10] states that restructuring is intended to:

- improve social equity by specially addressing the energy requirements of the poor;
- enhance the efficiency and competitiveness of the South African economy by providing low-cost and high-quality energy inputs to industrial, mining and other sectors; and
- achieve environmental sustainability in both the short- and long-term usage of our natural resources.

According to the White Paper, electricity sector reform will be based on introducing competition into the industry by restructuring Eskom generation into competing generation companies, with transmission separate [10].

2.1 Context of the electricity industry

While Eskom appears to have performed well on several fronts (low price of electricity, electrification of 2.5 million households), some of the factors that have made this possible are not, in fact, sustainable. Contributors to the low cost of electricity are access to large resources of cheap coal; the use of generation technologies that maximise economies of scale and exploit the lowest value (and cost) of coal; exemption from taxation and dividends; financing subsidies; over-capacity from power stations which are already fully paid for; and the omission of environmental costs from the price of electricity [5, 6, 8].

Over-investment in coal-fired power plants in the 1980s led to excess capacity, so that Eskom has not had to invest significantly in new power stations for some years, which reduces overall costs. Three power stations are, in fact, 'mothballed', and the debt for constructing power plants has largely been paid off. When new investments have to be made, costs and electricity prices will rise. Eskom expects that R100 billion of new investment will be required over the next 25 years [11], for an estimated capacity of 15 000-25 000 MW [12].

Eskom investments have effectively been subsidised with public money – through, for example, the Reserve Bank providing forward cover and thus protecting Eskom against changes in exchange rates. Not having to pay tax and dividends, even after investments in power plants had been paid off, benefited Eskom by R22 579 million between 1986 and 1998.[8] Even with this subsidy, Eskom's debt burden was high in the 1980s, but over time the loans have been paid off. This is reflected by the high debt-equity ratio of Eskom in 1986 at 2.93, which declined to 0.85 in 1998[8] and to 0.63 in 2000.[13] A debt-equity ratio of 1.00 means that only half of the liabilities of the company would be financed by borrowing (debt), the rest from other provisions, such as capital development funds, loans redeemed and other capital receipts that reflect the use of retained earnings of the company to support assets. In a commercial firm, lower debt repayments would have been replaced by higher payments of dividends to shareholders, but this did not happen with Eskom as a public company. With the capital costs having been paid off, consumers are currently paying only for energy costs.

The overall effect of all these factors is that the price of electricity does not reflect economic costs (the value of the inputs used to produce electricity): the long-term costs of increasing capacity are not reflected (tariffs are not 'cost-reflective'), nor are externalities priced. External costs are an important category of market failure, in which the social costs of a good or service are not the same as the private costs. They arise when an individual's welfare is affected, and that impact is not compensated or otherwise represented in the market price [14]. The situation in the SA electricity industry, where externalities are not internalised, favours non-renewable energy sources over renewables, since the environmental benefits of the latter are not priced in the market.

2.2 Potential impacts on social and environmental benefits

Social and environmental programmes usually have public benefits, but if private companies are unable to internalise them, they have no incentive to invest in them [5]. Environmental benefits of the current situation include demand-side management and energy efficiency (eg the Bonesa Efficient Lighting Initiative). Renewable energy projects have been implemented primarily off-grid, although research and development of large-scale renewables under Eskom's SA Bulk Renewable Energy Generation (SABRE-Gen) programme has begun.

A major social benefit of the current Eskom structure has been its financing of electrification. With plans to restructure, the burden of funding electrification has been shifted to the general treasury; the need for a National Electrification Fund has been accepted, to be resourced from tax and dividend income, and able to receive grants. The proposal for restructuring envisages that electrification will continue at a rate of 300 000 connections per year from 2001 to 2005 and 200 000 connections per year thereafter, requiring an estimated capital subsidy of R840 million per year be given by government to regional electricity distributors for the first five years and R560 million per year thereafter [15: 14].

The impacts of restructuring on social public benefits have been described in detail elsewhere [5, 6, 16]; in the following section, we focus in greater detail on environmental benefits.

3. Renewable energy

The Energy White Paper encourages the entry of multiple players into the generation market [10]. One of the biggest opportunities for renewables under restructuring is the prospect of renewable independent power producers (IPPs) entering the electricity market. Renewable IPPs face a number of barriers, however, as was revealed in a study, commissioned by the Department of Minerals and Energy (DME), of the prospects for bulk renewable IPPs [17]. Key obstacles for renewable IPPs are the present low cost of Eskom's electricity and the lack of non-discriminatory third party access to the grid.

Renewable energy has a different cost structure to traditional power sources, with high initial costs for construction, but low operation and maintenance costs. Coal-fired power plants, by contrast, have high operation and maintenance costs, including the use of fuel. Renewables have clear major environmental benefits, despite high initial costs, however, reducing local air pollution and helping to combat global climate change. If energy tariffs took into account the full external costs of coal production and the life-cycle costs of nuclear power, the costs of renewable power would appear more favourable. Investing in renewables has higher up-front costs, but has major benefits for society in the longer-term.

Furthermore, high initial capital costs could be recovered from future sales, given adequate electricity prices. Eskom's average price for electricity sold in 2000 was 13.23 c/ kWh [13], a price at which it would be impossible to recover the high initial capital costs of renewables from sales revenues. In the medium term (2005-2010), however, new capacity will be needed and tariffs will increase; if predictions of a future average tariff of 24-40c/kWh by 2010 [17] prove accurate, there will be more scope for renewable IPPs.

Another possibility has positive revenue implications for renewable IPPs, when and if retail competition in introduced in SA: that of developing 'green power' markets, amongst customers who want to buy electricity generated only from renewable sources. Demand from customers who are prepared to pay a premium for cleaner energy has been a powerful instrument in retailing renewable energy in industrialised countries. The local equivalent market is probably small, with relatively few environmentally conscious consumers who could afford to pay a premium for 'green power'. In the short-to-medium term, the best opportunities may be in promoting 'green power' for businesses seeking to sell goods on international markets that value products produced with clean energy.

A further measure promoting renewables would be for government to provide production incentives, which would deal with the initial high cost hurdle. Other options include environmental taxation, externality adders, government assisted business development and green marketing. The DME background research paper [17] includes a table comparing advantages and disadvantages of policy tools.

4. Energy efficiency

An international review of restructuring in several industrialised and developing countries concluded that the restructuring process has given relatively little serious attention towards ensuring that investment in energy efficiency is maximised [1]. It also found that DSM programmes that existed prior to restructuring had subsequently been reduced in size and scope or sidelined.

DSM options can be divided into two categories: those that improve a utility's financial performance, and those that do not. Utilities typically undertake DSM activities that improve the load profile and thus pay for themselves, such as load shifting (encouraging consumers to use electricity at non-peak times), allowing interruptibility (eg switching off geysers remotely at key times), or strategic growth (promoting growth in demand during off-peak periods). Such interventions usually target larger customers, and reflect a concern to delay the need for new supply capacity, or to optimise the load profile. Other kinds of DSM, however, are seen to simply reduce demand, and thus revenue, and are therefore not pursued by utilities [16]. The difference between various kinds of DSM is illustrated in Figure 2. The lower part of the diagram shows a DSM option that is seen to simply reduce demand overall, reduce revenue and is therefore not pursued [16].

Vertically integrated natural monopolies are more likely to invest in energy efficiency than private companies, given the clear benefit of delaying investment in new power plants. Even in the first steps of restructuring the electricity supply industry (commercialisation), this incentive decreases as IPPs enter the market. DSM programmes under the restructured regime are likely to focus on load management activities rather than on public-interest energy efficiency. The key change relates to change of ownership. As long as ownership is with government, energy efficiency programmes are likely to be implemented, as they contribute to the social and environmental good of the country. When substantial ownership is transferred to the private sector, energy efficiency investment is lost, as it does not contribute to profit. Where it remains, however, energy efficiency can be used as a way of differentiating a product in a market supplying a homogenous good [1].

In South Africa, energy efficiency is one of government's goals, as expressed in the 1998 White Paper:

> [S]ince expenditure on energy constitutes a large proportion of the country's GDP (15%) and a particularly large proportion of poor households' expenditure, it is necessary to give attention to the effective and efficient use of energy. Energy efficiency and energy conservation considerations must therefore form part of an overall energy policy. [10]

Public benefit energy efficiency target the end-user (residential, industrial or commercial). Practical examples include education, training and public awareness campaigns; demonstrations and audits; direct installation of energy efficiency equipment in (typically small) commerce and industry; installation of efficient appliances in residential houses (e.g. compact fluorescent lights, efficient refrigerators and improved thermal efficiency of low-cost housing); and fuel-switching, e.g. from electricity and paraffin to gas for cooking). The public benefit of such energy efficient interventions has been shown in earlier research [18]. These economic analyses demonstrate the substantial economic and environmental benefits energy efficiency interventions yield for the urban poor.

5. Policy recommendations

In the context of restructuring in the SA electricity industry, there are several policies options to promote renewable energy and energy efficiency. Each is addressed below, together with the question of where funding for implementing such policies might be found.

5.1 Policies to promote renewable energy

Several policy options could promote renewable power production in a restructured industry:

- One way of removing the barrier of discriminatory third party access to the grid is to offer *power purchase agreements* to small-scale renewable IPPs, giving them a fixed contract and agreed price over a period of years, which would reduce risk and offer certainty that they can sell their power. Some observers suggest that establishing long-term power purchase agreements for IPPs could tie government and consumers into non-competitive prices for years to come [5, 6]. They are, however, essential if renewable IPPs are to have security that they will be able to recoup their high initial investment costs. Indeed, power purchase agreements need to be specifically structured to reflect the cost structure of renewables. To avoid the lock-in to fixed prices, it might be desirable to limit power purchase agreements to small-scale projects, such as renewable energy projects smaller than 50 MW (and energy efficiency equivalent to less than 10 MW). The assumption would be that as renewable IPPs become commercialised and grow, they are able to

compete with other technologies, but that while the technologies are still going through learning curves and reducing costs, they need the security of fixed contracts.

- Another policy option is to adopt targets for the percentage of renewable energy to be achieved within a particular time-frame. One means of doing this is to set a *renewable electricity portfolio standard*, which requires a fixed percentage of total electricity sales to be derived from renewable energy sources by a certain date. The DME has recently discussed a target of 5% renewable electricity by 2010 [19]. With a single utility, a renewable electricity portfolio standard would amount to the same as the renewable set-aside capacity of renewable power, eg 200 MW for five years, just under 0.5% of current capacity [17]. As the industry is restructured into several regional distributors, individual distributors can be required to either achieve this percentage, or buy credits from others who achieve more than their target. In other words, market mechanisms can be used to achieve the target at least cost. Required percentages of renewable energy could also be specified for integrated resource plans to be drawn up by the new REDs.
- *Research, development and demonstration* is a critical activity to promote renewable energy, and its location under restructuring should be clarified.

5.2 Policies to promote public benefit energy efficiency

Energy efficiency has clear social and environmental benefits, yet it is not clear that it will survive under restructuring. A key problem is that energy efficiency means forgone revenue for utilities, as it decreases the amount of electricity sold. A number of policies and measures should be used to promote energy efficiency in a restructured industry.

- Under restructuring, the National Electricity Regulator's setting of tariffs will be particularly important for energy efficiency, with a key question being whether the regulator is willing to compensate the utility for such lost revenues. Some agreement will have to be reached on this between the regulator, DME, Eskom and IPPs.
- Apart from the issue of lost revenue, the regulator could also require distributors to *invest a minimum percentage of total annual revenues in energy efficiency.* If so, it could be specified how much of this is spent on end-use efficiency, research and development and supply-side efficiency [16]. While energy efficiency should pay for itself in the long run, some initial funding might be needed through a mechanism for energy efficiency. Some countries, such as Norway and Denmark, have legislated a specified level of energy efficiency investment [1], and also require utilities to undertake integrated resource planning prior to investment decisions.
- Finding an appropriate *institution to champion energy efficiency* is vital. Under restructuring, utilities may no longer be the best institutions to promote energy efficiency. Especially if Eskom were privatised, many public-benefit functions would likely be lost. On the other hand, the technical capacity and contact with customers that Eskom has should continue to be used where DSM remains in the utility's interest [1]. An institutional home or agency for public-benefit energy efficiency needs to be found.
- *Coordination* between authorities, notably the DME and the National Electricity Regulator, is important for public benefits under restructuring. The DME (particularly through integrated energy planning) should provide overall strategic guidance, develop and enforce codes and standards, promote education and awareness campaigns on renewable energy and energy efficiency, develop policy, and co-ordinate government initiatives. DME work should relate closely to that of the regulator, which issues licences and sets tariffs. The regulator has in the past used a combination of benchmarking exercises, rate-of-return regulation and performance-based regulation [16] – that is, it has not only looked at the financial viability of projects, but also considered other factors, including social and environmental ones.
- *Codes and standards* should be set for energy efficiency. Such codes could include the South African Energy and Demand Efficiency Standard (approved by the South African Bureau of Standards), standards for energy efficiency in low-cost housing, appliance labelling, standards for energy efficiency in industry and commerce and others [16].

5.3 Financing environmental benefits

The policies options outlined above require financial resources. Alternative options should be explored for financing renewable energy and energy efficiency.

- A *non-bypassable systems benefit charge* could be levied. Such charges have been introduced in several states in the USA and are usually introduced with retail competition. Essentially, a small charge is added to customers' electricity bills, and the revenue collected is spent on specified items, such as energy efficiency, renewable energy, or research and development [1]. In the current context, where many distributors are not financially viable, additional charges will be politically difficult to motivate. Such charges in other countries are, however, usually very small [1].
- The funding of a public benefit programmes can be by taxes. Eskom became a tax-payer from the beginning of 2000. Although certain tax allowances mean that no tax is payable for the first few years, the group was required to provide for deferred tax in the amount of R1.454bn [20]. Renewable energy and energy efficiency would compete with funding for electrification and, possibly, demands from local government.
- Renewable energy should have access to finance at reasonable rates, which traditional power utilities enjoy. Financing from international utilities with green energy targets, or concessionary financing through the Global Environmental Facility, Clean Development Mechanism, development banks or venture funds could reduce the cost of capital for renewables.
- Income to government from the sale of energy sector assets could be used on a once-off basis for funding renewable energy capacity. A trust fund for environmental benefits could be established.
- Finally, funding of research, development and demonstration of renewable energy technologies is important to their development. While Eskom is already undertaking the SABRE-Gen project, research, development and demonstration are only effective if they lead to the commercialisation of renewable energy.

6. Conclusion

Strategically, the key question is how to protect social and environmental benefits in a restructured industry. Politically, there is probably now greater support for social benefits, such as access to energy, electrification, services to rural areas and black economic empowerment. It is not always as easy to motivate for environmental goods such as renewable energy and energy efficiency.

In the short term, while South Africa still has excess generation capacity and regional electricity distributorss are being established, the focus should fall on energy efficiency measures, an energy efficiency institution, power purchase agreements, and non-discriminatory access to the grid for renewable IPPs. In the longer term, the Regulator should set a renewable electricity portfolio standard for electricity generation, and require distributors to invest a minimum percentage in energy efficiency. A systems benefit charge is one possible mechanism to finance such measures. These efforts need support from public interest research capacity.

References

1. Clark, A., Demand-side management in restructured electricity industries: An international review, (Energy & Development Research Centre, University of Cape Town, 2000).
2. Winkler, H., Mavhungu, J., Green power, public benefits and electricity industry restructuring, (Energy & Development Research Centre, University of Cape Town, 2001).
3. Dubash, N., The public benefits agenda in power sector reform *Energy for Sustainable Development* **V**, pp. 5-14 (2001).
4. Reddy, A. K. N., Indian power sector reform for sustainable development: the public benefits imperative *Energy for Sustainable Development* **V**, pp. 74-81 (2001).
5. Eberhard, A., Competition and regulation in the electricity supply industry in South Africa. Paper for the Competition Commission, (University of Cape Town, 2000).
6. Clark, A., Implications of power sector reform in South Africa on poor people's access to energy: Lessons for Africa, N. Wamukonya, Ed., Proceedings of the African high-level regional meeting on energy and sustainable development for the ninth session of the Commission on Sustainable Development, Nairobi (United Nations Environment Programme, 2001).
7. Edjekumhene, I. & Amadu, M. B., Brew-Hammond, A., Preserving and enhancing public benefits under power sector reform: the case of Ghana *Energy for Sustainable Development* **V**, pp. 39-47 (2001).
8. Steyn, G., A competitive electricity market for South Africa: The need for change and a strategy for restructuring South Africa's electricity supply industry, (for the Department of Minerals & Energy, 2000).
9. NER, EDI restructuring update in *Electricity Regulatory Journal*. (National Electricity Regulator, 2001), vol. August 2001, pp. 1-3.
10. DME (Department of Minerals and Energy), White Paper on Energy Policy for South Africa. (DME, Pretoria, 1998)
11. Chalmers, R., "SA needs to invest in the generation of its electricity," *Business Day*, 12 July 2001.
12. Chalmers, R., "SA must get it right first time," *Business Day*, 17 July 2001.
13. Eskom, Annual Report 2000, (Eskom, 2000) www.eskom.co.za.
14. Baumol, W. J., Oates, W. E., *The theory of environmental policy* (Cambridge University Press, Cambridge, ed. Second edition, 1988); Pearce, D., Turner, R. K., Economics of natural resources and the environment, (Harvester Wheatsheaf, 1990).
15. PWC (PriceWaterhouseCoopers), Consolidated emerging views. Electricity distribution industry restructuring project: Working paper 7. (Johannesburg, 2000)
16. Clark, A., Mavhungu, J., Promoting public benefit energy-efficiency investment in new power contexts in South Africa, (Energy & Development Research Centre, University of Cape Town, 2000).
17. DME (Department of Minerals and Energy), Background research on renewable energy independent power production, South Africa. Supported by DANCED. (Pretoria, 2000)
18. Spalding-Fecher, R. & Clark, A. & Davis, M., Simmonds, G., Energy efficiency for the urban poor: Economics, environmental impacts and policy implications, (Energy & Development Research Centre, University of Cape Town, 1999); Winkler, H., Energy-efficiency in low-cost housing: Costs and benefits of global and local externalities., Paper presented at the Domestic Use of Energy conference, 10-12 April 2001, Cape Town (Cape Technicon, 2001).
19. DME (Department of Minerals and Energy), Strategy on renewable energy. Draft. (Pretoria, 2001)
20. Chalmers, R., "Eskom net profits hit by R1,5bn tax provision," *Business Day*, 5 April 2001.

Figures

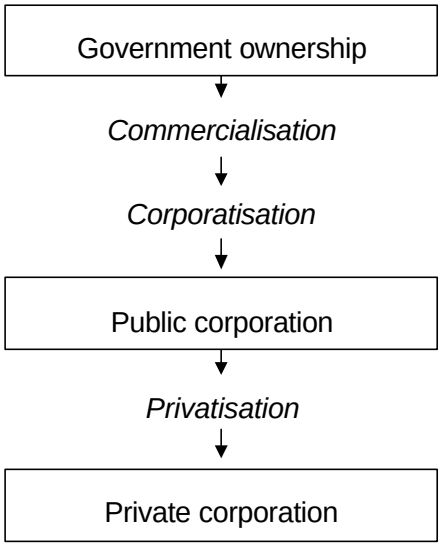

Figure 1: Steps from government to full private ownership

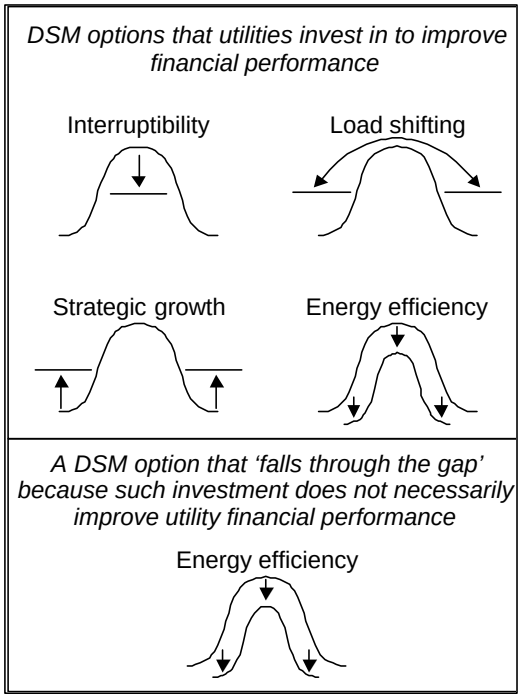

Figure 2: Demand side management options

Source: Clark & Mavhungu 2000