

# **BACKGROUND INFORMATION FOR ELECTRIFICATION PLANNING:**

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**THE INSTITUTIONAL FRAMEWORK FOR ELECTRIFICATION PLANNING  
OVERVIEW OF ELECTRIFICATION STATISTICS  
ELECTRIFICATION PLANNING - AN INTERNATIONAL REVIEW  
KEY ISSUES IN ELECTRIFICATION PLANNING  
STAKEHOLDER OPINIONS ON ELECTRIFICATION PLANNING  
PLANNING CONSIDERATIONS FOR RURAL ELECTRIFICATION**

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# **The Institutional Framework for Electrification Planning**

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## **1. Introduction**

This document will attempt to outline the current status of the electricity distribution industry in South Africa. There are a number of initiatives which, in the short term, will act to change this structure. Firstly there is the current licensing process, whereby all electricity undertakings have applied to the National Electricity Regulator (NER) for a licence to operate, and the subsequent inability of the NER to license without clarity on policy regarding the restructuring of the industry. Secondly there is the take-over of former homeland utilities by Eskom. Thirdly there is the restructuring of local government and the declaration of new local authorities in urban and rural areas of the country. These factors will act to partially, and possibly radically change the existing structure of the distribution industry.

## **2. A brief history of the electricity supply industry**

The commercial supply of electricity was first introduced in Kimberly and the Witwatersrand in the 1880s shortly after the discovery of gold and diamonds. In fact, electricity was an important factor in establishing the viability of deep-level gold mining, particularly for cooling in the ventilation systems. By the turn of the century, at least two private electricity supply companies were operating in the Witwatersrand and all the major cities were supplying electricity to local businesses and residents. In 1906 the Victoria Falls Power Company (later renamed the Victoria Falls and Transvaal Power Company - VFTPC) established its presence in the Witwatersrand and within a few years had established a virtual monopoly over power supply to the gold mines.

In this early period, the structure of the industry was characterised by a number of private and municipal enterprises operating under limited state regulation. The Transvaal Power Act, passed in 1910, required that 'surplus profits' (an agreed fixed percentage of profits) be redistributed to users on a pro-rata basis. This rebate system then became the standard for other provinces.

In 1922 the new Electricity Act established an Electricity Supply Commission (Escom<sup>1</sup>) whose central mandate was to provide electricity to 'Government departments, the South African Railways and Harbours Administration, local authorities, companies and other persons carrying on industrial undertakings or to any other persons whatsoever in the Union'<sup>2</sup>. The two main motivations for the establishment of Escom were firstly the perceived need to create an integrated industry to ensure a reliable and cheap supply of electricity; and secondly the desire of the South African Railways to electrify the railway system, particularly to transport export coal to the coast. The frequent disruption of municipal supplies due to strikes during and after the First World War was seen by railway management as a threat to this plan.

Escom was established as a state corporation which asserted a public presence in the electricity supply industry, but did not exclude the continued activities of private utilities. However, the 1922 act did give the state the power to expropriate the VFTPC should it wish to. At the same time, a rudimentary regulatory structure was put in place - Escom had a mandate to supply electricity at neither profit nor loss, and an Electricity Control Board was established to license electricity undertakings and to settle any disputes. Importantly, government departments and municipalities were exempt from the requirement to secure a licence. This exemption was partly a pragmatic acknowledgement of the existence of many such electricity suppliers, and

partly a reflection of the political power which local authorities wielded at the time. The measure is important in that it effectively restricted Escom's ability to rationalise the electricity supply industry and limited it to being a bulk supplier to local authorities and a direct distributor to large industry and rural areas. This situation is only now changing as a consequence of Eskom's electrification programme. A second effect of the exemption clause is that, since the Electricity Control Board only had the power to approve tariffs of licensed undertakings, municipalities were beyond its jurisdiction.

Escom was required to submit its annual report to the Minister of Mines and Industries, who had the power to react to management's plans, but not to directly interfere in policy and management. Although Escom undertakings required licences from the Electricity Control Board, this authority did not review its tariff increases, which instead had to be approved by Cabinet. The requirement that Escom operate without profit or loss was applied to each separate undertaking carried out by the commission. In effect this meant that there could be no regional cross-subsidies and thus the ability to embark on rural electrification projects was limited. The amending act of 1947 allowed the Minister, in certain circumstances, to direct Escom to provide electricity to unviable rural areas.

Although established as a public enterprise, Escom has always enjoyed considerable managerial independence from government. For the first seven years of its existence, Escom was permitted to borrow from the state Treasury, and thereafter it had to finance itself through market borrowing, bond issues and revenues. It has always managed to obtain relatively cheap capital and its bond issues have been regarded as safe investments by both foreign and local investors. In fact Eskom's treasury has been rated as one of the top ten in the world and its largest bond, the Eskom 168, is a benchmark in South African capital markets (Van Horen 1994a).

Although local authorities retained and exercised the right to supply electricity within their areas, a close relationship was established between Escom and all the major municipalities. Eventually Escom took over most of their major power stations and provided bulk supplies to the municipalities' distribution agencies.

Over a 25 year period, Escom and the VFOTPC co-existed as electricity supply agencies in the Transvaal. Early on Escom exercised its muscle by competing for, and obtaining, the right to commission new generation capacity in the province. In many cases Escom would finance and own new power stations and the VFOTPC would operate the plant, purchase power from Escom and sell it at a profit to the gold mines. The regulatory mechanism whereby a portion of VFOTPC's profits was rebated to users was still enforced, but mine owners resented what they saw as the company's manipulation of the system. Eventually, and partly as a result of pressure from mine owners, VFOTPC was nationalised in 1948 at a cost of £14.6 million. Although this was ostensibly to reduce electricity costs, it was also consonant with similar post-war nationalisation strategies in other countries and served the interests of Afrikaner nationalism by removing a major British economic institution.

The fact that municipalities could retain the right of supply without licence has been central to the development of the distribution industry. It has not only led to the proliferation of distribution authorities and tariffs, but also meant that domestic electricity supply became closely associated with Apartheid policy. White local authorities were concerned primarily with electricity supply to white residential and commercial areas and generally did little to extend service to adjacent townships, which in any case were technically outside their jurisdiction. In 1973 the Bantu Administration Boards were established to take over the supply of services to townships, but did not have access to the diverse revenue base of white local authorities, and township electricity distribution remained underdeveloped. In the early 1980s, township electricity supply was taken over by the newly established black local authorities (created by the Black Local Authorities Act of 1982). Political resistance to these bodies included electricity payment boycotts, and effectively precipitated a crisis in urban service provision.

Another important link between Apartheid policy and the structure of the electricity supply industry was the establishment of separate utilities in the former homelands and self-governing territories. In each of these areas, either a separate 'state' owned utility was established<sup>3</sup> or electricity supply became a line function of a 'state' department. As with municipalities, these undertakings did not require a licence from the Electricity Control Board. However, the majority of these bodies have suffered from financial and managerial difficulties and have lacked the capacity to make the necessary investment in transmission and distribution infrastructure. As a consequence, most of these regions still have exceptionally poorly developed distribution systems and correspondingly low levels of access to electricity. Eskom is currently in the process of implementing take-overs of these supply authorities.

During the period up to the 1970s, Eskom benefited from continually improving technical efficiencies, the creation and extension of a national grid,<sup>4</sup> continuous demand growth and increasing economies of scale. Gradually Eskom was able to supply more electricity and to supply it more cheaply than other generators, and by the early 1980s generated over 90% of total electricity supply. Towards the end of the 1970s Eskom's performance was adversely affected by a range of problems common to many utilities around the world. Although not dependent on oil as power station fuel, Eskom suffered from high inflation rates, increased finance charges (associated with currency depreciation and a high level of foreign debt) and a reduction in the pace and effect of technical improvements. At the same time, Eskom had over estimated capacity requirements and invested heavily in unnecessary generation facilities.<sup>5</sup> The annual tariff review and the 'break-even' requirement lead to high and erratic tariff increases in the mid-1970s and again in the early 1980s. These tariff changes, together with the high proportion of total foreign debt attributable to Eskom, led the Government to appoint a commission of inquiry in 1984 led by Dr de Villiers.

The De Villiers report strongly criticised Eskom's unnecessary expansion of generation capacity. The report also drew attention to problems in Eskom's accounting practices, low labour productivity and flaws in the regulatory regime. A two-tier control structure was recommended, consisting of an Electricity Council and a management board. The Electricity Council was intended to be analogous to a company's board of directors and included stakeholder representation from industry, commerce, municipalities, government, Eskom management and industry experts (all appointed by the Minister of Mineral and Energy Affairs). Its tasks were to set policy for Eskom and to appoint and oversee the management board. Many of De Villiers' recommendations were adopted in 1985/6 and these effectively transformed Eskom into a publicly owned business-style corporation under more structured state control. Tariffs still had to be passed by Cabinet and the act required the Electricity Council to consult the Minister over issues relating to national policy, thereby ensuring a government role in policy formulation. The zero profit principle was replaced by a requirement

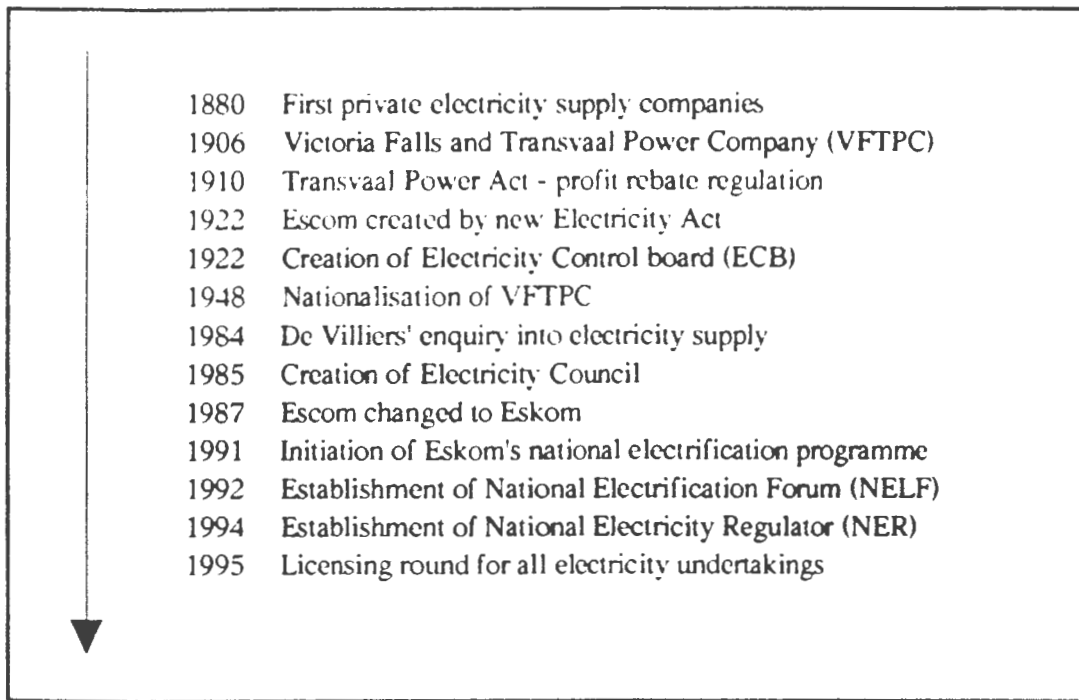
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<sup>3</sup> In the case of the self-governing territories of Kangwane and Gazankulu, the local utilities were established as joint ventures with Eskom.

<sup>4</sup> It should be noted in passing that the 1971 amendment to the Electricity Act allowed the different regional undertakings to be connected, thereby facilitating the establishment of the national grid and uniform pricing policies, and do allowing some level of cross-subsidisation within tariff categories. The amendment also established a Capital Development Fund.

<sup>5</sup> Eskom forecast an annual growth in electricity demand of 7%, whereas the actual growth in the 1980s was 4.5% per annum. In fact, Horwitz (1994) goes further than attributing excess capacity simply to forecasting mistakes, and suggests that the regulatory regime and Eskom's accounting practices predisposed it to making large capital investments.

to supply electricity in the most cost-effective manner and accounting practices were changed. The act also reduced the powers of the Electricity Control Board as Eskom was no longer required to obtain a licence for its operations. It is important to note that the scope of De Villiers' enquiry did not include an investigation into the distribution business of the industry, and so the performance of municipal distributors was never questioned.



**FIGURE 1:** History of the electricity supply industry

The adoption of De Villiers' recommendations must be seen in the light of the Government's interest in privatising the utility - an option which even now has not been completely ruled out, either by Eskom management or Government. Eskom management maintain that the restructuring in the mid-1980s allowed the corporation to operate according to standard business principles. Since 1984 Eskom has shed a third of its employees and tariffs have consistently and steadily declined in real terms. In 1991 Eskom committed itself to a price compact, whereby it undertook to meet a range of financial, productivity and other targets,<sup>6</sup> including substantial real price decreases. This commitment has recently been extended to a further 10% price reduction from 1996 to 1999. Tariff increases in 1994 were 5% below the rate of inflation.

The regulatory reforms resulting from the De Villiers enquiry dealt mostly with Eskom, and left the distribution side of the industry largely unchanged. Since local distributors are under the control of municipal councils, regulation was assumed to be effected through the electoral accountability of these councils. However, in the past this accountability has been restricted to 'white' communities, and has rarely dealt with the needs of neighbouring townships.

<sup>6</sup> The price compact commits Eskom to (1) reduce electricity prices by 20% over five years; (2) increase productivity by 20% over the same period; (3) improve its debt to equity ratio; (4) maintain service standards; (5) further electrification without cross-subsidies from non-domestic customers; (6) use excess capacity to sell electricity to industry at prices above short-run marginal costs; and (7) base price adjustments on revenue requirements (Steyn, 1994).



3. The current structure of the electricity supply industry

Figure 2 illustrates the current structure of the electricity supply industry. Generation and transmission is dominated by Eskom. A few municipalities still own their own power stations, but these are generally only used for backup purposes since Eskom has, in the past, offered incentives to encourage municipalities not to use these stations. The exception is Johannesburg which has access to cheap coal. Eskom currently generates 98% of all electricity sold in South Africa.

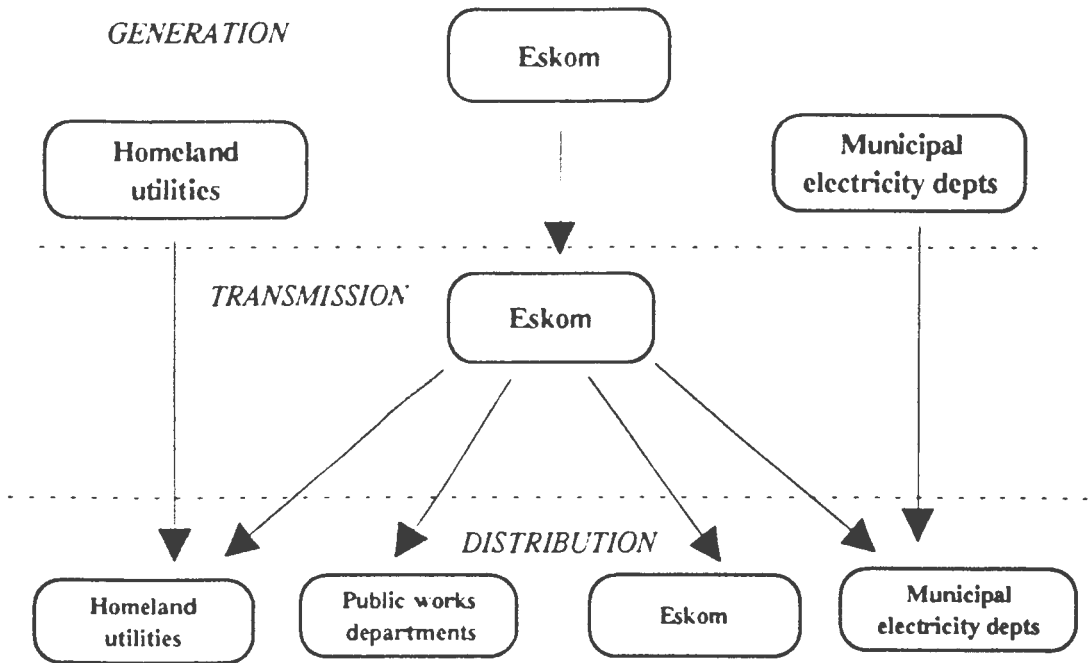


FIGURE 2: Structure of the electricity supply industry (pre-licensing round)

Eskom also owns and operates the national grid which connects all of Eskom's customers to the transmission network. The grid currently consists of 25 000 km of high voltage transmission lines, most of which is operated at 400 kV and 275 kV.

In the former homeland regions, regional utilities undertook distribution and, in the case of Transkei, some generation. In the case of Transkei, Venda and Boputhatswana, electricity supply corporations were established - Tesco, VEC and Becor respectively. These corporations generally had full supply rights to the entire homeland. An exception is the Transkei where two municipalities had (and still have) supply rights - Umtata and Butterworth. In Kangwane and Gazankulu joint ventures were established with Eskom - Kescor and Gezicor respectively - which had full supply rights to their respective areas. In KwaZulu, supply rights were split between the KwaZulu Government, Eskom and Durban Electricity (which supplied electricity within the 'Durban Functional Region'). In other former homeland areas (Lebowa, QwaQwa and Ciskei), electricity supply was managed by government departments.

In most cases listed in table 1, Eskom is in the process of negotiating take-overs of the relevant supply authorities. In the Transkei, all of Tesco's staff and customers have been transferred to Eskom, leaving Tesco as a company holding assets and liabilities only. Both Becor and VEC still exist, but it is likely that take-overs will soon be effected. In other homeland areas, the transfer of supply rights from former government departments to Eskom has been more easily effected.

Area	Authority with supply rights
Transkei	Tescor + two municipalities
Boputhatswana	Becor
Venda	VEC - Electricity Department of Venda National Development Corp.
Ciskei	Department of Public Affairs
Gazankulu	Gezicor (joint venture with Eskom)
Kangwane	Kescor (joint venture with Eskom)
KwaNdebele	KwaNdebele Government
KwaZulu	KwaZulu Government, Eskom and Durban Electricity
Lebowa	Lebowa Government
QwaQwa	Department of Works

**TABLE 1:** Supply rights and authorities in former homeland areas  
*Source: Horvei and Dahl 1994*

In contrast to the unified generation and transmission components of the industry, distribution is highly fragmented with over 300 separate distribution authorities in existence. It should be emphasised that the fragmentation of the distribution industry, coupled with direct control by racially-based local authorities has been one of the main causes of the relatively low levels of urban access to electricity. Although municipalities have traditionally made a generous surplus on electricity sales (total surpluses equalled R1.2 billion for 1992/3 - Eskom, undated), this source of money has not been available to finance the extension of the networks to neighbouring townships but has been used to supplement revenue from property rates (Steyn 1994). In the former homeland areas the existence of separate, and often financially troubled utilities has limited the potential to expand electricity supply in these largely rural areas.

Steyn (1994) asserts that the fragmented structure of electricity distribution has led to considerable inefficiencies in the industry. In some metropolitan areas there have been up to ten or twenty separate authorities controlling electricity distribution. The duplication of operating and maintenance infrastructure and the proliferation of standards and tariffs has led to wasteful expenditure. In addition, tariffs have been set to generate a required surplus rather than reflecting marginal costs. It is possible that these inappropriate pricing signals have encouraged inefficient consumer behaviour. Perhaps more importantly, local councils have generally exercised direct control over their electricity departments and have not allowed management much room for independent planning and decision making.

#### 4. Electricity supply and demand

The present state of electricity supply in South Africa will be discussed in terms of the generation, transmission and distribution components of the industry. In addition, costs of supply and some indicators of Eskom's performance will be presented. Lastly, the sectoral breakdown of electricity demand will be presented.

##### *Generation*

Although new investments in supply capacity have been cut since their peak in the early 1980s, and the commissioning of contracted new capacity has been postponed for as long as possible, Eskom still owns excess generation capacity. In 1994 Eskom had a surplus of 11 200 MW, over 30% of total capacity. This is less than the surplus available in 1994 due to increases in peak demand and decommissioning of old plant. In 1994 the peak demand increased by 7% to 24 800 MW, and reached 25 202 MW in July 1995. Although a surplus capacity of 30% is more than Eskom's stated requirement of 20%, it appears as though much of the mothballed capacity could never realistically be used due to both technical and environmental reasons.

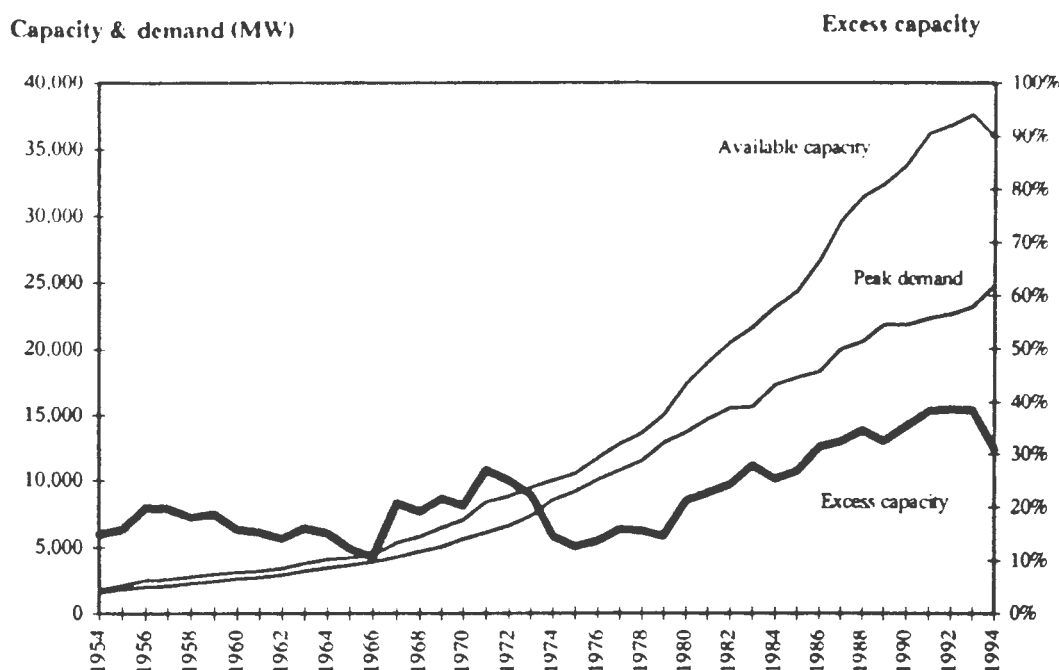


FIGURE 3: Growth in electricity supply and demand

Eskom's maximum capacity is 36 000 MW, of which 4 500 MW is in reserve. The bulk of this is in coal-fired thermal stations, largely located in the Eastern Transvaal highveld close to the country's main coal fields. A major constraint on power generation has been the availability of sufficient water resources and Eskom has become a world leader in dry-cooled thermal power technology. The concentration of power generation in the north of the country implies large transmission losses to the Western Cape, over 1 500 km away. Partly in response to this a nuclear power station was built at Koeberg, just outside Cape Town.<sup>7</sup> Although Eskom has planned the construction of further nuclear power stations in the Cape, it is unlikely that these will be built in the foreseeable future, if ever. The development of natural gas fields off the southern Namibian coast probably presents a more attractive fuel option for future generation capacity in the Western Cape. At present, Eskom still has a further 4 000 MW of coal-fired capacity on order (Majuba power station in Volksrust), the first sets of which are expected to come on line in 1996, and construction should be finally completed in 2001. In addition, construction is underway to reconnect the Cahora Bassa station to the South African grid.

In 1994, South Africa exported 1 583 GWh to neighbouring countries. Although this is only 1% of South African consumption, it indicates that some of South Africa's neighbours (particularly Lesotho, Swaziland, Namibia and Mozambique) are dependent on Eskom supplies. A very small amount of electricity is currently imported into South Africa, although this has not always been the case. In 1978-80 South Africa imported some 10% of electricity requirements, principally from the Cahora Bassa hydroelectric station in Mozambique. However, sabotage of transmission lines since 1980 has reduced the output of this station to negligible amounts.

<sup>7</sup> The development of an indigenous nuclear fuel cycle also had much to do with South Africa's nuclear weapons programme, which was abandoned in the early 1990s.

Ownership	Type	Number of stations	Net maximum capacity	Percentage of maximum capacity
Eskom	Coal fired - mothballed	3	4 531 MW	11%
	Coal fired - in operation	9	27 213 MW	69%
Eskom	Sub-total coal fired	12	31 744 MW	80%
	Gas turbine	2	342 MW	1%
	Hydroelectric	2	600 MW	1%
	Pumped storage	2	1 400 MW	4%
	Nuclear	1	1 840 MW	5%
<b>Total Eskom<sup>1</sup></b>		<b>19</b>	<b>35 926 MW</b>	<b>91%</b>
<b>Local authorities<sup>2</sup></b>			<b>2 474 MW</b>	<b>6%</b>
<b>Private self-producers<sup>2</sup></b>			<b>1 077 MW</b>	<b>3%</b>
<b>TOTAL</b>			<b>39 777 MW</b>	<b>100%</b>

1 Eskom statistics as at 31 December 1994.

2 Statistics for local authorities and private producers are based on 1989 figures.

**TABLE 2: Breakdown of South Africa's generation capacity**  
Source: Eskom 1995a

### Transmission and distribution

Although the national grid is extensive, there is limited excess transmission capacity and the system is continually being strengthened as required. Eskom currently owns 25 000 km of high voltage main transmission lines, and a further 38 000 km of medium voltage distribution lines. The utilities in the former homelands and self-governing territories were responsible for distribution in these regions. Only in the case of the Transkei did Tescor, the regional utility, own some generation capacity (three small hydroelectric sets sufficient for between 20 and 40% of requirements, depending on water availability).

Despite limited rights of access in urban areas, Eskom is still the largest single distributor, supplying approximately 25% of all customers. A further 25% are supplied by the five largest municipal distributors and the remaining 50% are supplied by the many other small municipal distributors. Durban Electricity is the largest municipal distributor in the country.

### Performance indicators

If the presence of excess capacity is ignored, Eskom's technical performance has always been good. Plant availability, one of the best measures of technical and managerial performance, has fluctuated between 75% and 80% over the past decade. Thermal efficiencies have been steadily and consistently improving from 20% in the 1950s to just over 34% in 1993. The load factor on the system has been exceptionally high, consistently around 75% over the past ten years, and is of significant advantage to Eskom. It is possible that the load factor may decline as household electricity consumption starts to affect peak loads.<sup>8</sup> However, demand-side management measures may still keep the demand profile relatively flat.

Losses in the national transmission system have been consistently low, especially by developing country standards. Figures reported by Eskom indicate that transmission losses have been between 5% and 7% over the past twenty years. If consumption in power stations and losses in non-Eskom distribution systems is included, losses have been between 13% and 17% (Eskom 1994b).

<sup>8</sup> It is significant that in the last two years the domestic peak has, for the first time, coincided with the national peak.

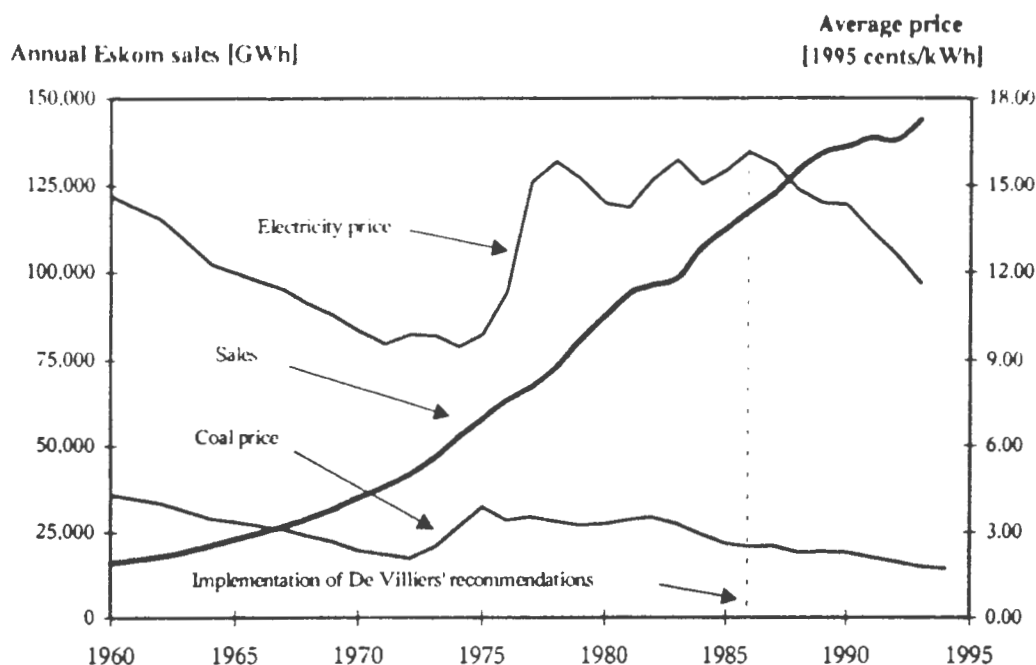


FIGURE 4: Electricity sales and prices

Financial performance is perhaps best indicated by average prices, given that until 1987 Eskom was required to balance its books. Figure 4 shows the average price history over the past thirty years. During the 1960s and early 1970s, real prices steadily declined. However, in the latter half of the 1970s, prices increased dramatically. It was during this period that Eskom management over estimated future demand and committed the utility to unnecessary investment and excessive foreign debt. After 1986, when the new electricity act implemented many of De Villiers' recommendations, real prices again began to decline. Eskom has recently recommitted itself to a real decline in prices of 15% over the next five years. A recent survey by the National Utility Services showed that average electricity prices in South Africa are the cheapest in the world (Business Day, 1995). Other of Eskom's financial indicators, such as the debt-to-equity-ratio, have also improved significantly over the past few years. However, Van Horen (1995) has concluded that the principle determinant of Eskom's financial health has been the levels of investment in generation capacity. As investment levels have declined since the 1970s, so Eskom's financial position improved.

#### Generation and transmission costs

By international standards, generation costs are remarkably low. Marginal costs of generation (which exclude transmission and distribution costs) currently stand at 1.1 cents/kWh. In the long-run these are expected to increase, in real terms, to 6 cents/kWh by 2010. Marginal transmission costs are highly sensitive to location, but the national average stands at R116/kW/year. Given a 75% load factor, this is equivalent to a marginal unit cost of 1.8 cents per kWh. Marginal transmission costs vary around the country depending on transmission losses and current loading on the lines. Current Eskom pricing policy allows for a 1%, 2% or 3% surcharge to reflect geographical cost differentials (Els 1994). In fact, these surcharges are insufficient to cover costs of transmission losses, and geographical cross-subsidisation is implicit in pricing policies.

### Electricity demand

In the 1960s and 1970s growth in electricity consumption was largely driven by the industrial sector. Since 1980 this rate of growth has declined dramatically, and industrial consumption even contracted in the latter half of the 1980s. Only in the past two years has demand growth begun to pick up again. A closer examination of changes in electricity consumption shows that the major factor which affected the dip in electricity demand over 1985-91 was depressed demand in the iron and steel industry and, to a lesser extent, gold mining. Demand growth in other sectors has, in fact, remained fairly consistent (EIU 1994a).

Figure 6 shows the breakdown of electricity consumption by different sectors. The high proportion of consumption due to industry and mining is primarily responsible for the high load factor on the system. Low domestic consumption may be attributed to the relatively low levels of household electrification and the relatively warm climate. The bulk of electricity is consumed by industry (50%) and mining (25%). Domestic electricity consumption accounts for some 15% of the total, and commercial enterprises consume a further 5%. Transport and agriculture account for the remainder (Eskom 1994b).

Annual Growth in electricity consumption and GDP

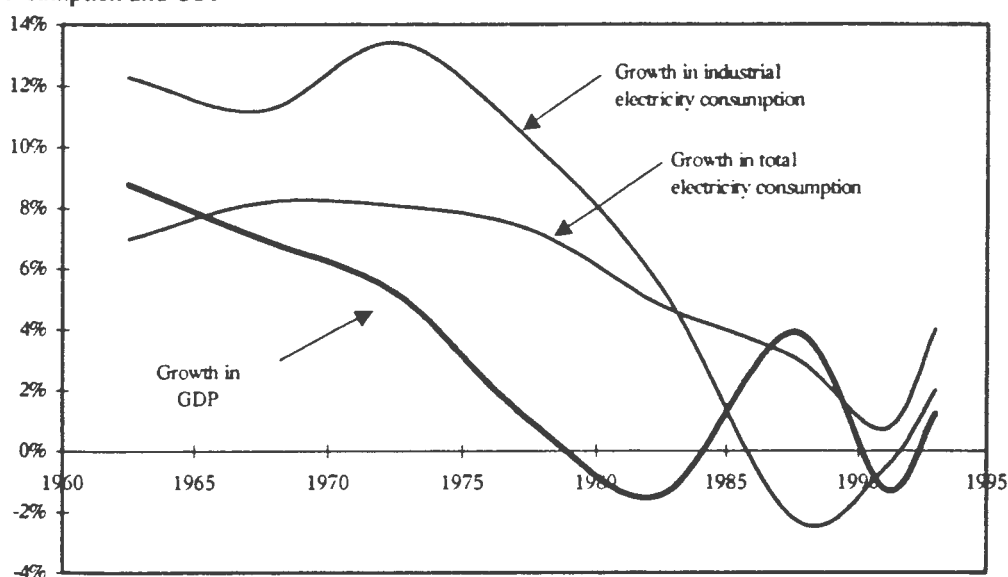


FIGURE 5: Growth in electricity consumption and GDP

Sources: Eskom 1994b; World Bank 1994; World Bank 1992; Economic Intelligence Unit 1994a

### Household energy consumption patterns

Energy consumption in low income households is characterised by multiple fuel use. It is common for households, in both urban and rural communities to rely on three, four or even more different fuels. Paraffin is commonly used for cooking and heating, as is coal where it is available. Bottled gas is often used by better-off families for cooking purposes. Wood is generally a free resource in rural areas, although its collection imposes a heavy burden, particularly on women who are mostly responsible for this task. In the absence of electricity, paraffin and candles are used for lighting, at a cost which far exceeds the cost of electrical lighting. Expenditure on both dry cell and car batteries, used to operate radios and televisions, can occupy a significant portion of the household's energy budget. Access to electricity generally replaces expenditure on candles and batteries, but the switch from other fuels towards electricity is slow and not well understood.

Percentage of total electricity consumption

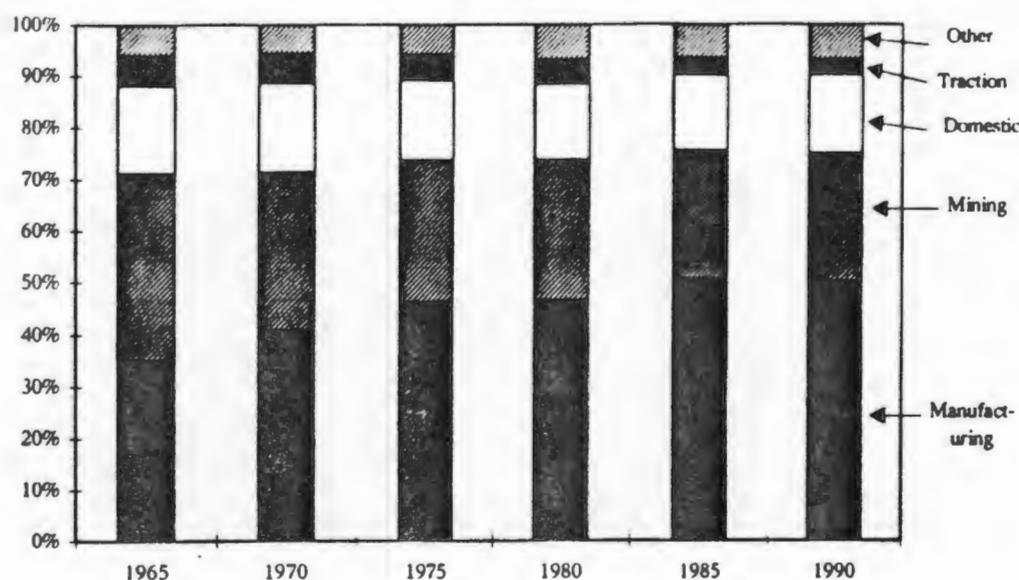


FIGURE 6: Breakdown of electricity demand  
Source: Eskom 1994b

Figure 7 shows average fuel expenditure (averaged over all households, whether they use the fuel or not), for electrified and unelectrified low income households in urban and rural areas of the country. It is clear that in electrified households, other fuels make up a substantial portion of total energy expenditure - as much as 35% in urban households and 65% in rural households.

Monthly household expenditure [1994 R]

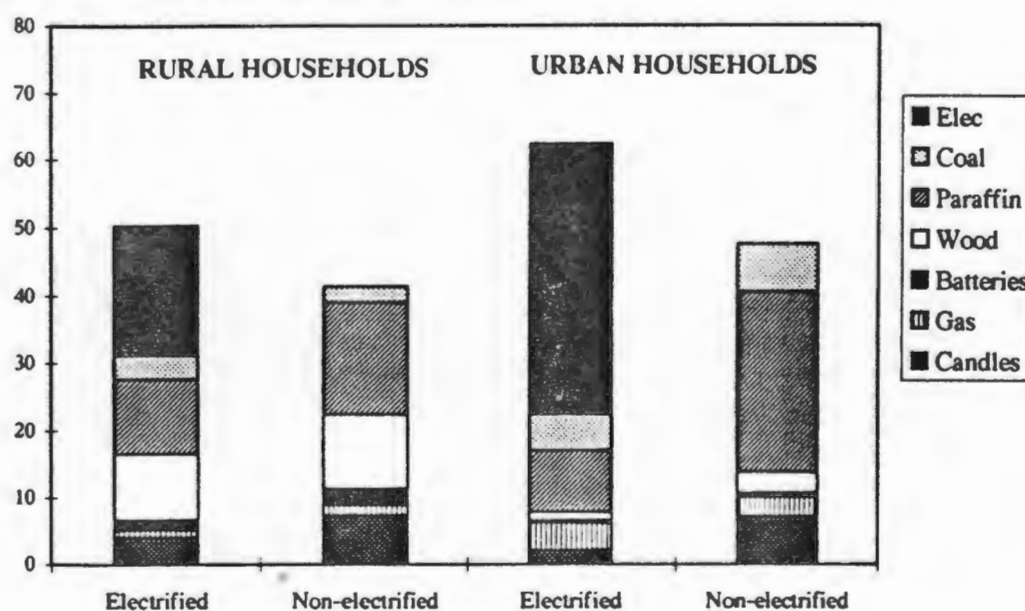


FIGURE 7: Energy expenditure (by all) of low income households  
Source: SALDRU 1995

Where coal or wood is used in the home the effects on indoor air quality can be severe. The health impacts of this on respiratory illness, particularly in children, have been found to be significant (van Horen 1994b), and the associated costs high (Yach et al 1994). Other health and safety effects in the home associated with fuel use include fires and burns (particularly in informal housing areas) and paraffin poisoning of children.

## **5. The National Electrification Forum (NELF)**

NELF was formed in May 1993 as a stake-holder forum to debate the design and implementation of a national electrification forum. Representation included Government, political parties, consumers, business, civic associations, trade unions and industry delegates. The forum formed working groups to examine various structural, regulatory and financing options for the industry. A report was submitted to Cabinet in 1994, and about the same time the forum was disbanded.

NELF's principle conclusions relate to the structure and regulation of the industry and are summarised below (NELF 1994):

- Improved regulation of the industry should be effected through the empowerment of the Electricity Control Board.
- The status quo of the generation and transmission sectors of the industry should be maintained. In effect this means that Eskom continue to dominate the generation of electricity (although other generators continue to be allowed to operate); and that Eskom should continue to operate the national transmission grid.
- The distribution sector of the industry should be restructured in two phases: a rationalisation and a consolidation phase. The rationalisation phase, to be implemented in the short term, includes the take-over by Eskom of electricity undertakings in the former homeland areas; and the partial rationalisation of municipal distributors, encouraged by the reformed Electricity Control Board. The consolidation phase is envisaged to be an evolutionary development of the industry towards one of two models: (1) where the industry consists of a national generation and transmission utility, and a separate national distribution utility, decentralised into regional distributors; or (2) a national generation and transmission utility and a number of metropolitan and local government distributors, with Eskom being the supplier of last resort.

Recommendations accepted by the Government essentially preserved the status quo of the industry, with the only significant change being the empowerment of the Electricity Control Board and its transformation into the present National Electricity Regulator.

NELF also made provisional recommendations on a number of issues that had not been fully resolved. These included:

- **Pricing and tariffs:** (1) the development of a set of pricing principles to provide for cost reflective tariffs and transparency of any taxes or subsidies; and (2) the implementation of a national domestic tariff system, allowing for 'life-line' tariffs for low income customers.
- **Financing:** (1) the reform of local government taxation of electricity distribution towards a consistent and transparent system; (2) urban electrification finance should be raised by urban distributors and cross-subsidies from within the distributor should be used to cover short-falls; (3) Government should assist in raising cheap capital and should contribute towards the costs of rural electrification.
- **Management and human resources:** electricity undertakings should be ring fenced financially and managerially in order to make financial transfers transparent, and to



facilitate the adoption of sound and efficient management practices. Any restructuring of the industry should not result in any loss of employment.

- Attention was also drawn to the fact that the extent of the electrification programme was dependent on the level of taxes on electricity and subsidies made available by Government.

## **6. Supply rights, the regulator and the licensing round**

In most cases distribution supply rights have been held on a local monopoly basis. That is, within any defined geographical area, the assigned supply authority has had full distribution rights. There are exceptions in the case of certain large power users (for example, the mines and large industry) which have been supplied directly by Eskom.

The distribution industry is highly fragmented with some 350 distributors in existence. In most urban areas, supply rights have been held by the local authority and exercised through the municipality's electricity department. In a number of urban areas supply rights have been split between different entities. In some of the metropolitan areas there have been a number of different municipal authorities supplying electricity as well as Eskom (Cape Town is a case in point with a large number of distribution authorities present). In many other urban towns, supply rights have been split between the different racially based local authorities in the town, with Eskom often taking over from authorities in the 'black' settlements.

In addition to this fragmented structure in urban areas, there are a number of cases where non-municipal authorities and even private enterprises have distributed electricity. In the Northern Province there have been examples of Regional Services Councils supplying electricity. Similarly in Natal there have been cases where the Natal Provincial Administration distributed electricity to small towns. In former homeland areas, the general rule was either for a public utility or a government department to supply electricity. Lastly there are a few cases of private companies distributing electricity, as in the case of Tongaat-Hewlett sugar company supplying the town of Tongaat.

The 1994 amendment to the Electricity Act 1987 transformed the Electricity Control Board into the National Electricity Regulator. The main functions of the regulator will be:

- to issue and revoke licences to generate, transmit or distribute electricity;
- to regulate towards the achievement of electrification targets;
- to regulate tariff structures and levels;
- to regulate standards and settle disputes; and
- to approve asset transfers and appropriation.

During the course of 1995, all electricity undertakings in the country which sell more than 5 GWh per annum, including distribution, transmission and generation activities, have had to apply for to the regulator for a licence. The Regulator concluded that it was impossible to issue licences without greater clarity from Government on policy regarding the restructuring of the distribution industry. Consequently, temporary licences have been issued for a nine-month period, preserving the status quo, and a period of six months has been set aside to resolve the pertinent policy questions.

The licensing process has co-incided with the restructuring of local government throughout the country. In metropolitan areas of the country (Cape Town, Durban and four regions in Gauteng), there are Transitional Metropolitan Councils (TMCs). In non-metropolitan areas, there are two tiers of local government. The upper tier consists of wall-to-wall district councils, mostly comprised of indirectly elected members. The lower tier of local government is different for urban and rural areas. In urban areas, racially based councils have had to either combine as a Transitional Local Council (TLC) or form a Local Government Co-ordinating Committee - temporarily maintaining the status quo until local government elections. In rural areas

provinces have three models of local government to choose from. Firstly there are Transitional Rural Councils - these are the rural equivalent of TLCs and are fully fledged primary local authorities. Secondly there are Transitional Representative Councils, which are bodies without administrative or executive functions. They exist to represent their constituents' interests and co-ordinate RDP activities. Lastly there are Remaining Areas where there is no primary level structure at all and residents vote only for representatives to district councils.

## **7. Eskom's distribution activities**

Since 1991 the distribution component of Eskom's activities has grown enormously. Prior to 1991 Eskom's customers consisted primarily of municipalities, large industrial consumers, the railways, government departments and commercial farmers in rural areas. At that time Eskom directly supplied some 300 000 customers. Since the start of the electrification programme, Eskom's customer base has grown to some 1.3 million customers. This includes new connections and take-overs from other supply authorities. In response to this increase, as well as to the demands of implementing the electrification programme, the structure of Eskom's distribution business has changed.

Prior to the recent changes, there were five regional distributors within Eskom - Pretoria, Johannesburg, Durban, Bloemfontein and Cape Town. Some of the functions of the old distributors have been centralised at head office, and there are now a series of regional offices throughout the country responsible for other functions associated with distribution.

There are three groups within Eskom responsible for its distribution business: Distribution, Electrification, and Marketing. Distribution is responsible for the Sales and Customer Services (SACS) function. There are 14 SACS regions throughout the country, each with a SACS manager. This structure and function forms the core of Eskom's distribution business. The Electrification division is responsible for the planning and implementation of electrification projects, including upgrading and maintenance of existing networks. A national electrification planning department has been established at Eskom head office and is responsible for co-ordinating the electrification projects of the regional offices. However, the long term objective is to integrate electrification planning functions into SACS business.

Marketing is responsible for providing advice through four marketing services, as well as co-ordinating research throughout the country. The marketing services offered to Eskom customers are Agrelek, aimed at the agricultural market; Industrelek, which targets industrial customers; Electroserve, which interacts with commercial users; and Electrowise, which serves domestic customers.

### ***Electrification planning within Eskom***

Electrification planning within Eskom is based on a set of electrification plans, each of different duration. At the broadest level, there is a 20 year electrification plan, which essentially sets out possible electrification scenarios and is used to estimate the associated financial and technical requirements. The medium term, five year plan entails the setting of electrification targets per province and sub-region within each province. The plan takes into consideration financial and technical constraints and serves to allocate resources to each of the regions. Criteria used to set targets and identify sites include least cost considerations which take into account existing supply infrastructure and demand patterns; as well as policy decisions on regional resource allocation.

More detailed planning is conducted within a two-year and a 12-month planning window. The two-year plan identifies a preliminary set of projects which have been identified using least cost criteria, and negotiated with relevant stake-holder forums. The plan is updated on a quarterly basis using a 24-month moving window. This is supposed to allow sufficient time for adequate detailed planning to occur.

The 12-month plan comprises the final project list which is also updated on a quarterly basis. Every three months the new projects for the final three months of that 12 month period will be reviewed and approved, including the approval of the capital involved.

In certain areas, masterplans have been developed, detailing the orderly expansion of the grid. An example of this is in the Transkei where the limited nature of the distribution network requires substantial investment in both transmission upgrades and medium voltage lines.

Despite the existence of policy requiring a certain minimum financial return on electrification projects, it is clear that the pressure of meeting electrification targets tends to over-ride any such considerations. In addition, experience in many areas is that consultation with local communities dictates the pace and focus of the electrification programme.

Current Eskom policy is to provide streetlights only in localities where a municipal authority exists and is willing to pay both installation and operating costs. Since streetlighting is one of the main benefits of electricity supply in residential areas, it is likely that there will be increasing pressure on Eskom to reconsider this policy. Any such policy change will clearly have cost implications (particularly in rural areas where densities are low) and will affect Eskom's resource allocation plans.

## **8. Other distribution agencies**

### **8.1 Municipal supply authorities**

Municipal supply authorities account for the bulk of the distribution industry in South Africa. Most of these authorities are only involved in the distribution of electricity, although a few also have some generation (and pumped storage) capacity. The largest such undertaking is Durban Electricity which supplies the greater Durban area. Durban Electricity has undertaken a large-scale electrification programme, aiming to supply electricity, on request, to all residents within its area of supply. In other metropolitan areas, supply rights have been divided between a number of different supply authorities.

Revenue from urban electricity sales provides a substantial surplus which is used to subsidise municipalities' rates accounts. Although the level of this surplus (alternatively referred to as a 'tax' on electricity) varies from town to town, the average for the four largest distributors in 1992/3 was 17% of revenue (Steyn 1994). Not only are other municipal services financially dependent on surpluses from electricity sales, but the electricity department affects municipalities, particularly in small towns, in other ways: the status of the municipality affected by the size of its electricity department, and there are also economies of scope whereby other municipal functions benefit from the administrative and technical capacities of the electricity department.

Although there is no detailed research investigating this particular issue, it has been commented that many municipal distributors are inefficiently run (Steyn 1994). Clearly, if this is the case there is a huge cost attached to this inefficiency - not only in terms of current operations but also the additional costs associated with an inefficiently implemented electrification programme.

### **8.2 Non-municipal public participation in electricity supply**

There are a number of precedents for public involvement (in addition to municipal distributors) in electricity supply distribution throughout the country. In the former homelands, there are cases of government departments taking direct responsibility for electricity supply - for example in QwaQwa, Lebowa and Ciskei. In Natal there are cases where the Natal Provincial Administration has operated electricity supply in small towns.

There are also a number of examples of state funding of electrification programmes. Outside of the former homeland areas, this has been primarily effected through the regional services

councils (RSCs). Examples include electrification projects in both urban and rural settlements where RSCs have provided additional funding to install electricity distribution infrastructure. There are also special cases in the Free State where RSCs have subsidised farmworker electrification projects.

### **8.3 Private and foreign participation in electricity supply**

The vast majority of electricity undertakings in the country are publicly owned. However, there are a few examples of privately owned electricity undertakings. In Tongaat the Tongaat-Hewlett sugar company generates electricity from 'waste' products, and uses this for its own needs as well as distributing to the immediate locality (although it appears as though Durban Electricity will take over this function soon). There are also examples of AECL distributing electricity within industrial estates owned by the company.

Foreign participation in South Africa's electricity sector has primarily been through the purchase of Eskom bonds. In fact, nearly 50% of all Rand-denominated Eskom bonds are held by non-residents. In addition to this, Eskom has negotiated technology and management agreements with a British (East Midlands Electricity) and French utility (EdF). Similar collaboration is being sought with United States and Japanese companies (Eskom 1995a)

## **9. Financing options for electrification projects**

There are a number of sources of financing for electrification projects. These are as follows:

- **Financial markets:** including loans, bond issues, and more complex tools such as Eskom's Electrification Participation Notes (EPNs).
- **Concessionary finance:** the Development Bank of Southern Africa provides loans for electrification projects on concessionary terms.
- **Grants:** these might include funds from foreign sources, local grant finance institutions as well as government.
- **Capital development funds:** many municipalities have accumulated reserves which can be used to secure investment finance.
- **Cross-subsidies from other customers.**

Although constituted as a state corporation, Eskom neither contributes to nor draws from the state treasury. All finance is raised from the market. Potgeiter (1995) estimates that Eskom needs to raise between R2 billion and R3.5 billion per annum from the domestic and foreign financial markets, of which approximately R1 billion will be required for electrification capital expenditure (Van Horen 1995). The total requirement includes the servicing of existing debt and repayment of maturing debt. In 1994 Eskom invested a total of R808 million in electrification projects and a further R880 million on the construction of Majuba power station (Eskom 1995a).

The principle finance mechanism used by Eskom are long term (more than three years) fixed interest bonds. The most popular of these is the E168, which Eskom actively trades. Short term liquidity is ensured through the use of a Commercial Paper Bill with maturities of up to 12 months. A special instrument is the Electrification Participation Note (EPN) which was issued with the express purpose of financing electrification projects. The EPN is comprised of three parts - a fixed interest rate of 6%, a floor linked to the E168 bond and a warrant component linked to revenues from electrification projects. There have been two issues of EPNs which have raised R1.2 billion. Eskom is currently seeking loans for electrification projects from the DBSA on concessionary terms.

The electrification of schools and clinics has been largely funded through grant finance. The Independent Development Trust (IDT) has a clinic electrification programme and has funded the supply of electricity to rural clinics. Both grid and off-grid technologies (mostly solar

photovoltaic systems) have been used. The Norwegian Agency for Development Cooperation (NORAD) has provided some R15 million to be used towards the electrification of schools and clinics. Eskom has also contributed an equal amount from its Community Development Fund. Much of this has been used to provide internal wiring in buildings, as well as funding connections and short line extensions where necessary. Some of the funds have been used to install photovoltaic installations at remote rural clinics and schools.

In comparison with Eskom, which has a well managed and effective treasury, financing options for municipal distributors are limited. The ability of these agencies to raise sufficient finance to cover the costs of electrification has been questioned. Some such agencies have built up capital development funds from annual revenues, and have used these funds to secure financing. The DBSA has also provided loans to municipal electricity undertakings on concessionary terms.

A financial analysis of electrification projects reveals that in many cases revenues from electricity sales are inadequate to ensure the required return on the investment. In other words, even if capital financing can be obtained, there is a need for ongoing financial support to cover operating losses (including interest payments). In some cases the need for these subsidies may decrease and eventually disappear as revenues pick up. In other cases, cash flows might be expected to remain negative for the entire lifetime of the project. Eskom, as well as other distribution agencies, currently covers these losses through the use of cross-subsidies from other customers. It has been estimated that a cross-subsidy of 5% of Eskom's total revenues is adequate to cover Eskom's losses (Els 1994). Municipalities, who have access to a much small revenue base, have a more limited ability to raise adequate cross-subsidies.

## **10. Consultation, negotiation and community participation**

There are three levels at which electrification planning has engaged in a consultation process with stakeholders. At the national level NELF saw the negotiation of a set of annual targets for a national electrification programme. With the dissolution of NELF, there has been no dedicated structure which can act as a forum for the interaction of stakeholders and supply institutions. At present, the NER is in a position to act as a national watchdog, overseeing the implementation of electrification targets. Eskom also interacts directly with various task teams of the RDP office.

At a regional level Eskom has acted to establish a number of Regional Electrification Forums. Examples of these are in KwaZulu/Natal where the electrification forum is a sub-committee of the Regional Economic Forum; and in the Eastern Cape where there are three Regional Electrification Forums. To date these forums have primarily been used to ensure that there has been wide acceptance of plans, and transparency in the selection of sites (Lithole 1995). There has been little active involvement of these committees in electrification planning.

At a local level, Eskom attempts to establish local electrification committees. These structures are primarily used as an interface between Eskom and the local community, and deal primarily with implementation issues.

Recent policy changes within Eskom suggest that in the future consultation and negotiation will be closely aligned with RDP structures. At the national level there is to be interaction with the RDP office. At provincial levels, there will be interaction with the provincial MEC for the RDP and any inter-departmental committee which may be established. At lower tiers, it is suggested that district level committees will participate in the prioritisation of settlements within that district. However, it appears as though Eskom would only countenance any changes to the existing plan if additional funding was made available (assuming that the changes had cost implications). Since these district level committees are unlikely to have access to financial resources, it is unlikely that any such changes would be made. Lastly, the local working committees are envisaged to continue to function as an interface between Eskom and the community, dealing mostly with implementation issues.

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# Overview of Electrification Statistics

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EDRC  
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## 1. The Eskom-NELF<sup>1</sup> demand-side database

This resource contains demographic and electrification data compiled from a variety of sources. The data covers both population and housing figures and categorises the population according to locality and housing type. Firstly there is the distinction between urban and rural areas. There is no generally accepted definition of 'rural' and 'urban', and a third category - semi-urban or peri-urban - is commonly used in an attempt to attain greater clarity. The 1991 census defined urban areas as all localities with some form of local authority; semi-urban areas as those localities which are urban in nature, but without any form of local government; and rural describes all other areas. The issue is complicated by the fact that the definition of 'semi-urban' was not applied to former homelands, where rural was used to refer to all areas outside of proclaimed towns (with the exception of Boputhatswana).

In addition to urban and rural definitions, the data is also categorised by housing type, as detailed below. In urban areas there is a formal housing group, as well as three categories of informal housing. A further category termed 'institutions' refers to police stations, prisons, schools, hostels, hotels and so on. In this category there are no 'households' in the usual sense. Rural areas are disaggregated even further into eight categories, depending on the density of the settlement, the type of housing, and whether commercial farming is practised on the land.

<b>Urban:</b>	Formal housing	<b>Rural:</b>	Farmworker formal housing
	Planned informal housing		Farmworker informal housing
	Unplanned informal backyard housing		Farms
	Unplanned informal housing		Scattered formal housing
	Urban institutions		Scattered informal housing
			Dense formal housing
			Dense informal housing
			Rural institutions

The population and housing data is based on 1991 figures and adjusted to 1993. Projections are made to 2012 (a 20 year time horizon) based on anticipated population growth rates and household formation. An attempt has been made to verify and reconcile the housing and population data contained in the Eskom-NELF database with other sources (EASy, undated), and most inconsistencies have been resolved. Electrification statistics have been updated as connections have been made, up to the end of 1994.

The accuracy of the database is adequate to meet the second objective outlined above, i.e. for informing policy and resource allocation on a macro level. However, its use as a detailed planning tool for the electrification programme is limited. It can certainly be used to identify potential electrification sites over a medium-term time horizon (five years), but at present it is inadequate for shorter term, more detailed planning. A major weakness from an electrification planning perspective is that the database does not include details of the proximity and status of existing network infrastructure, or housing layout, and hence it is impossible to rank localities on the basis of least cost. In order to achieve this, the information must be integrated with that contained in the Eskom-NELF supply-side database, which contains information on many distribution agencies (Eskom, undated). There is currently a collaborative initiative between Eskom and the Department of Housing to transform the Eskom-NELF database into a GIS system containing this information, together with updated statistics on housing.

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<sup>1</sup> NELF - the National Electrification Forum.

## 2. Electrification statistics

It is estimated that at the end of 1994, there were close to 8.4 million households in South Africa with an average size of 4.6 people. Of these households, 44% were estimated to have access to electricity, equivalent to 40% of the total population. Using the definition of rural contained in the Eskom-NELF database, the rural population accounted for 52% of the population (47% of households). Within this rural group, 12% of households have electricity. The provincial breakdown is given in Table 1.

Province	Population (000)	Houses (000)	Percent <sup>1</sup> Rural	Elec. backlog <sup>2</sup>			Access to electricity <sup>4</sup>		
				Urban	Rural	Total	Urban	Rural	Total
E Cape	6 504	1 357	70%	191	863	1 054	60%	2%	22%
E Tvl	2 673	531	70%	81	271	352	56%	22%	34%
Gauteng	6 434	1 575	4%	391	27	418	74%	54%	74%
K/Natal	8 137	1 673	60%	192	867	1 059	74%	7%	37%
North West	3 182	665	70%	72	410	482	66%	10%	27%
N Cape	760	171	30%	33	39	72	71%	34%	58%
Northern	4 944	997	90%	33	762	795	70%	14%	20%
Free State	2 495	554	42%	119	169	288	65%	21%	48%
W Cape	3 557	863	15%	107	67	174	86%	47%	80%
<b>Total</b>	<b>38 687</b>	<b>8 386</b>	<b>52%</b>	<b>1 219</b>	<b>3 475</b>	<b>4 694</b>	<b>72%</b>	<b>12%</b>	<b>44%<sup>5</sup></b>

1 These figures exclude people living in institutions (hostels, old-age homes, etc.)

2 Thousands of connections

3 Based on population ratios, not housing ratios.

4 Based on housing ratios. Electrification statistics based on population ratios are slightly lower.

5 Given that a further 128 000 connections have been made by Eskom from January to June 1995 (Du Plessis 1995), this total should have edged up to 45-46%.

TABLE 1: National electrification statistics - December 1994

Source: Eskom 1995c

The three provinces of KwaZulu/Natal, Northern Province and Eastern Cape all have rural populations of over 4 million and together account for 70% of South Africa's rural population. These three provinces also have some of the lowest levels of rural electrification. It is anticipated that much of the rural component of the national electrification programme will occur in these provinces, together with North West Province. It is no coincidence that these provinces contain the bulk of the former homeland populations.

### Urban electrification

It can be seen in Table 2 that the level of electrification in formal urban housing is relatively high - close to 80% nationally. It is in informal areas, and 'unplanned' informal areas in particular, that urban electrification levels are low. It is expected that the electrification programme in urban areas will be aimed primarily at these groups of residents.

Urban housing type	Houses	Electrified	Not electrified	% electrified
Formal housing	3 500 000	2 700 000	800 000	77%
Formal institutions	285 000	250 000	35 000	87%
Informal planned housing	508 000	198 000	310 000	39%
Informal unplanned housing	206 000	26 000	180 000	13%
Informal backyard dwellings	147 000	36 000	111 000	25%
<b>Total</b>	<b>4 696 000</b>	<b>3 210 000</b>	<b>1 486 000</b>	<b>68%</b>

Figures are rounded to the nearest 1 000.

TABLE 2: Breakdown of urban electrification by housing category - 1994

Source: Eskom-NELF 1995

Electrification levels in the four main urban centres are given in Table 3.

	Houses	Access to electricity	Electrification backlog
Gauteng <sup>1</sup>	1 673 000	71%	480 000
Cape Town <sup>2</sup>	587 000	81%	110 000
Durban <sup>3</sup>	398 000	80%	79 000
Port Elizabeth <sup>4</sup>	211 000	55%	95 000

1 Including all magisterial districts in the Gauteng province

2 Including the magisterial districts of Bellville, Cape, Goodwood, Mitchells Plain, Paarl, Stellenbosch, Strand, Somerset West, Wynberg

3 Including the magisterial districts of Durban, Chatsworth, Umlazi, Pine Town, Inanda and Vulamehlo.

4 Including the magisterial districts of Port Elizabeth and Uitenhage

**TABLE 3:** Electrification statistics in main urban areas - 1994

Source: Eskom-NELF 1995

### Rural electrification

Both dense and scattered rural settlements, which are located primarily in former homeland areas, have exceptionally low levels of access to electricity. Approximately one quarter of farmworkers on commercial farms have access to electricity, but this is much lower than the level of access which farm owners have. This indicates the opportunities for extending electricity to farmworkers on farms which already have an electricity supply point.

Rural housing type	Houses	Electrified	Not electrified	% electrified
Farmworkers	476 000	107 000	369 000	22%
Commercial farms	71 000	31 000	40 000	43%
Dense settlements	658 000	35 000	623 000	5%
Dispersed settlements	2 700 000	185 000	2 515 000	7%
Rural institutions	285 000	250 000	35 000	88%
<b>Total</b>	<b>4 190 000</b>	<b>608 000</b>	<b>3 582 000</b>	<b>15%<sup>1</sup></b>

1 This figure is different to that in table 1 due to the inclusion of rural institutions

Figures are rounded to the nearest 1 000.

**TABLE 4:** Breakdown of rural electrification by housing category - 1994

Source: Eskom-NELF 1995

Demographic and electrification data concerning farmworkers on commercial farms appear to be inadequate to support electrification planning. Although the Eskom-NELF database does contain figures for farmworker electrification, Eskom personnel feel that this is, at present, inaccurate (van der Walt 1995).

### Breakdown by supply authority

At present, there is inadequate data to accurately assess the levels of electrification for different supply authorities. Given the fragmented nature of the distribution industry (over 300 suppliers exist throughout the country), and the current review of supply licences by the National Electricity Regulator, it is extremely difficult to compile these statistics. It is hoped that the Regulator will be in a position to compile these after completion of the current licensing round.

### Schools and clinics

The electrification of all schools and clinics has been identified as a priority by the Government - the Reconstruction and Development (RDP) white paper sets the target of electrifying all such facilities as soon as possible. The total capital cost of achieving this has been estimated at R850 million (Hambley et al 1995).

It is estimated that there are approximately 16 500 schools and 2 500 clinics currently without access to electricity (Theron 1995). These figures represent electrification levels of 27% and 53%

for schools<sup>2</sup> and clinics respectively. In addition, the construction of new schools and clinics over the next five years will add further to the total number of unelectrified facilities.<sup>3</sup> Although the absolute number of electrified clinics should increase by some 60% over five years, the relative extent of clinic electrification is likely to remain more or less constant at just over 50% (Hambley et al 1995).

Of particular concern is the accuracy of existing information on the location and electricity needs of schools and clinics. Figures for the total number of unelectrified schools vary from 15 000 (Buttle 1995) to 19 300 (Hambley et al 1995). Estimates for the number of unelectrified clinics is more consistently, although perhaps not more accurately, quoted at 2 500. A database detailing the location and essential features of schools and clinics has been compiled at Eskom and is being updated.

### 3. The national electrification programme

Eskom embarked on an electrification programme towards the end of 1991. The subsequent formation of the NELF led to the development of a set of scenarios for the implementation of a national electrification programme for the entire distribution industry. The mid-range scenario has been adopted by Eskom and the RDP as a set of targets for the distribution industry. The proposed annual numbers of household connections to be made over the next five years are given in Table 5.

	1994	1995	1996	1997	1998	1999
Eskom	250 000	300 000	300 000	300 000	300 000	300 000
Non-Eskom	100 000	100 000	150 000	150 000	150 000	150 000
<b>Total</b>	<b>350 000<sup>1</sup></b>	<b>400 000</b>	<b>450 000</b>	<b>450 000</b>	<b>450 000</b>	<b>450 000</b>

1 Actual total achieved = 378 000.

**TABLE 5:** The national electrification targets: domestic connections for 1994-1999

Source: Schoeman 1995

Given the estimated rate of household formation, and the existing level of electrification, these targets should lead to an increase in access from 44% of dwellings in 1994 to 65% in 2000 (Theron 1995). However, most of the remaining unelectrified households will be in rural areas and it is estimated that 68% of rural homes (2.7 million dwellings) will still be without electricity by the turn of the century (calculated from Schoeman 1995). If connections continue to be made at a declining rate (decreasing to 200,000 per annum in 2010), the national level of access to electricity should reach 80% by 2012 (Van Horen 1994).

Connections by non-Eskom distributors are expected to be made largely in urban areas, with some involvement by municipalities in areas surrounding the town or city (Durban Electricity is an example of a municipal authority with supply rights stretching into the surrounding rural areas). The extent of proposed electrification in rural areas depends on definitions of rural. If rural is defined as all areas except towns and cities with populations exceeding 100 000, then it has been estimated that between 65% and 70% of annual connections will be rural. The majority of these (85%) are likely to be made by Eskom. Using the same definition of rural, between 80% and 90% of Eskom's planned electrification projects will be in rural areas. However, this definition is not consistent with the DBSA which defines any settlement of over 5 000 people as urban.

<sup>2</sup> The figure for schools refers to DET, former homeland and farm schools only.

<sup>3</sup> The IDT plans to build approximately 200 new clinics per annum and the Department of Education has allocated funds sufficient to build 4 000 classrooms (133 schools) per year for the next five years.

#### 4. Capital and financing requirements for electrification

There are different ways of investigating the financial impact of the electrification programme, and it is important to distinguish between them:

- Firstly, there are the *capital costs* required to implement the programme.
- Secondly, there is an *investment analysis* which attempts to evaluate the *net present value* of the programme, taking into account all costs and revenues, but irrespective of financing considerations.
- Thirdly, there are the *financing requirements*, which is the cumulative sum of capital requirements and annual losses/surpluses, net of finance changes.
- Lastly, there is a *cash flow analysis*, which takes account of capital expenditure, annual losses/surpluses as well as finance changes on debt. If debt financing is used, the cumulative cash flow will be greater than the total financing requirement.

There have been three attempts to investigate the financial impact of the electrification programme: NEES (1993), which investigated three electrification scenarios; van Horen (1994), who investigated a 'business-as-usual' scenario and an 'IEP' scenario; and Els (1994), who looked at the electrification plan proposed by the RDP. In terms of connection rates, van Horen's IEP scenario, the NEES scenario two and Els' scenario are all broadly similar - a peak of 450 000 to 500 0000 connections per year.

All three studies reach broadly similar conclusions regarding the capital requirements of the programme. The NEES scenario two looked at the years 1993 to 2010 and concluded that the capital expenditure would be in the order of R28 billion (1993 terms). Van Horen calculated that the total capital requirement over the slightly shorter period 1994 to 2010 would be in the order of R22 billion (1993 terms). The difference is partly due to a shorter time period, but also because the NEES analysis had a higher average cost per connection, and also included high expenditure on unelectrified rural farms in the middle of the programme. Els looked at the longest period: 1992 to 2012 and arrived at a total capital requirement of R23.2 billion, in 1994 terms. These totals correspond to an annual capital requirement of R1.2 to R1.5 bn (Van Horen 1995), of which approximately 75% will be spent by Eskom

Table 6 presents the essential assumptions and results from the three studies. Although connection rates, support costs, losses, and consumption rates are roughly similar, there are important differences regarding supply costs, refurbishment and tariffs. Els assumed a higher bulk supply cost and also assumed real tariff decreases (13% over four years) as contained in Eskom's pricing compact. Els included finance charges in calculating the annual cash flow - which was not done in the other two studies.

Els points out that a distinction should also be made between embedded (or average) costs and incremental (or marginal) costs. If the costs of electrification are to be based on embedded costs, then this means that new consumers are expected to pay for their portion of previously installed infrastructure. If costs are based on incremental costs, then new consumers are only required to pay for the additional costs which they impose on the system. In Eskom's case where surplus generation capacity, embedded costs are higher than incremental costs, at least in the short term. Els opted to use embedded costs in the calculations. Although the other two studies did not make this explicit, it appears that they used (lower) incremental costs. Although Els argues that the use of embedded costs ensures that all customers share the burden of past investments, the economic argument is that the use of incremental costs is a more accurate reflection of the true costs of the programme.

A second distinction should also be made between historic and current costs. This affects pricing policy in that tariffs are calculated to recover current investment costs, that is they are calculated to escalate with inflation so that when new investments in refurbishment and

replacement have to be made, there is no sudden jump in tariffs. However, if all figures are expressed in fixed prices, this consideration should not affect the result.

	<i>NEES</i>	<i>Van Horen</i>	<i>Els</i>
Base year	1993	1993	1994
Cost per connection <sup>1</sup>	R4 000	R3 500	R3 800
Bulk supply cost	9.5c/kWh	11.2c/kWh	16.2c/kWh <sup>2</sup>
Support cost	R15-R20/mth	R20/mth	R15-R23/mth
Refurbishment	included in bulk supply cost	2% of capex per annum	20% at yr 10; plus 50% at yr 20
Consumption <sup>3</sup>	150 - 450 kWh/mth	150 - 450 kWh	150 - 450 kWh/mth
Tariffs	18c/kWh	20c/kWh	22c/kWh <sup>2</sup>
Losses	20%	12%	20%
Real discount rate	4%	3%	6%
Electrification 'levy'	n/a	4%	5%
Capital investment	R28 bn	R22 bn	R23.2 bn
Financing requirement	R28 bn	R22.4 bn	n/a
Financing req. after levy	n/a	R9.2 bn	n/a
Cumulative cash flow <sup>4</sup>	n/a	n/a	- R70 bn
Cum. cash flow after levy	n/a	n/a	- R3.4 bn
Net Present Value	- R19.4 bn	- R18 bn <sup>5</sup>	- R11.7 bn

1 This varies for housetype, region and time. Averages are presented.

2 Declining by 6% real in year 1, 6% in year 2, and 1% in years 3 and 4.

3 Consumption is different for each consumer category and varies with time.

4 This include finance charges assuming 100% debt finance.

5 Calculated from cash flows presented by van Horen.

**TABLE 6:** Essential assumptions and results of financial analyses

The conclusion of the NEES analysis and van Horen's study is that operating losses are small in comparison to capital costs, and that operating losses turn into surpluses after approximately 10 years (if the urban and rural components are combined - the rural component never generates a surplus). The NEES analysis concluded that total annual cash flow would not turn positive over the duration considered and that the financing requirement after 20 years would be R28 billion. Van Horen arrived at a similar result, concluding that the financing requirement would be negative R22.4 billion. Els' study arrives at a different result - the cumulative cash flow would be negative R70 billion - two to three times greater than that estimated by van Horen and NEES. The principle reason for this difference is that Els calculated a different quantity from the other studies: Els calculated the cumulative cash flow (which includes finance charges assuming that all financing requirements are met by debt) and the other studies arrived at the financing requirement before interest charges.

Van Horen (1995) has estimated that cumulative operating losses to date have amounted to more than R300 million. If this amount is spread over all new customers over the past three years, the loss per customer per month is close to Theron's (1995) estimate of R20 per month for each newly electrified customer. If finance charges are included (assuming that all losses and capital expenditure are covered by debt), the loss increases to R60 per customer per month (Theron 1995)<sup>4</sup>. Clearly, finance charges have the effect of dramatically increasing the operating loss and it is this which accounts for most of the difference in results between Els and the other two studies.

It should be noted that the negative cash-flows experienced in the electrification programme are not all financed by debt. Cross-subsidies from other customers are also used. Els looked at the effect of using cross-subsidies to cover annual operating losses and found that these were

<sup>4</sup> It should also be noted that these losses will decrease as consumption increases.

equivalent to levy of approximately 5% of other electricity sales. These cross-subsidies dramatically reduced financing requirements over 20 years from R70 billion to R3.4 billion. Van Horen looked at the impact of a 4% levy on electricity generation and found that this reduced the peak cumulative financing requirement to R9.2 billion

Only Els' report separated Eskom's costs from those experienced by other distributors and found that Eskom would bear approximately 75% of capital costs, cross-subsidies and financing requirements. Els concluded that although this appeared achievable for Eskom, there were doubts concerning the ability of non-Eskom distributors to raise both the necessary finance and cross-subsidies.

## 5. Progress to date

The electrification programme started in earnest at the end of 1991. Since Eskom does not have the rights of supply to many unelectrified urban areas, an incentive scheme was introduced to encourage municipal distributors to undertake electrification projects.<sup>5</sup> Eskom refunded R400 of the cost of each new connection in an attempt to promote urban electrification. Bulk discounts were also available to municipal distributors on the basis of their electrification programmes. The number of indirect incentive connections can be taken to represent the total number of connections made by non-Eskom distributors. The Table below summarises the achievements to date.

	to Dec 1992	1993	1994	1995 (to June)	Total
Eskom prepayment connections	177 000	209 000	254 000	128 000	768 000
Farmworker connections	13 000	16 000	17 000	9 000	54 000
Incentive indirect connections	23 000	70 000	107 000	31 000	231 000
<b>Total</b>	<b>212 000</b>	<b>295 000</b>	<b>378 000</b>	<b>168 000</b>	<b>1 053 000</b>
Eskom capex (R'000)	R472m	R584m	R808m	R385m	R2 250m
Capex per connection	R3 036	R2 799	R3 179	R3 004	R3,070

Note: figures are rounded to nearest 1 000

**TABLE 7:** Electrification progress to date  
Source: Eskom 1995a and du Plessis (1995)

A more detailed breakdown of Eskom's electrification programme, costs and sales for 1994 is given in Table 8. It can be seen that during this year the cost per connection varied significantly between the Eskom distributor regions. Capital costs were lowest for the Johannesburg region where the bulk of connections are made in high density urban areas. Costs were significantly higher for the Durban region which deals with difficult topographical conditions in KwaZulu/Natal. Eskom's target is to reduce average connection costs to R2 200 through the use of innovative technologies and new technical standards.

Support costs are in the region of R20 to R30 per customer per month. Contrary to expectations, support costs in the Johannesburg distributor are the highest. Eskom's target is to reduce average support costs to R17 per customer per month.

The cost to Eskom of the incentive schemes whereby municipalities receive bulk discounts and contributions towards the cost of new connections totalled R39 million during 1994. This figure is made up of R30 million of contributions towards municipal distributors' capital expenditure, R4.7 million towards incentive schemes on farmworker houses, and bulk discounts to municipal distributors worth R4.6 million.

<sup>5</sup> These incentives have now been discontinued.



	Connections	Capex [R'000]	Cost per connection	Ave sales [kWh/month]	Support [R/month]
Bloemfontein	44 000	121 000	2 730	79	21
Cape Town	47 000	140 000	2 968	123	18
Durban	44 000	214 000	4 890	88	18
Johannesburg	46 000	89 000	1 950	67	32
Pretoria	73 000	243 000	3 322	55	28
<b>Total</b>	<b>254 000</b>	<b>808 000</b>	<b>3 179</b>	<b>80</b>	<b>26</b>

Figures for total number of connections and capex are rounded.

**TABLE 8:** Breakdown of 1994 costs and sales for each Eskom engineering region  
*Source: Eskom 1995b*

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# **Electrification Planning An International Review**

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**EDRC  
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## 1. Overview

This paper is an attempt to present, in the very briefest of terms, diverse electrification experiences from a range of countries. The case studies have been selected to illustrate a number of different aspects of electrification planning, although the common theme concerns the institutional structure of the electricity supply industry and mechanisms by which electrification planning has occurred. There is a bias in the review towards rural electrification, since it is distribution projects outside of the urban areas which are generally not financially viable (at least in the short term) and hence require special attention.

Probably the most important issue concerns the role of national governments in electrification. In all cases reviewed here there has been some level of state involvement. At the very least, the state has been responsible for initiating electrification planning and in many cases has established a fairly comprehensive electrification policy. Korea is probably the extreme case (outside of centrally planned economies) where the government promulgated a law outlining detailed procedures for electrification planning and implementation. In most cases, the state has delegated responsibility for designing and implementing the details of electrification to other bodies, generally public institutions of some form. In Zimbabwe, Ireland, Greece and Thailand, responsibility for electrification planning was passed onto existing national utilities. In a number of countries, the government created special state bodies to coordinate electrification planning - both India and Bangladesh established electrification boards with the task of planning and financing electrification projects. Even in the United States, despite (or perhaps because of) the presence of private utilities, rural electrification was initiated and financed by the state, and implemented by non-profit cooperatives. Clearly, where utilities are public bodies, and where there are a limited number of utilities (often only one), it is much easier for the government to task them with the responsibility of carrying out government policy. Where utilities are more independent, or even privatised corporations, the ability of the state to direct electrification would depend very much on the regulatory regime in place.

It is worthwhile distinguishing the various functions involved in electrification. Initiating, planning and coordinating an electrification programme are often perceived as legitimate areas of government concern. These functions require a policy framework, and it might be argued that it is the development of this framework which is government responsibility, and more detailed planning should be left to a utility or dedicated state body. Financing is a critical aspect and the options will be constrained by the structure of the industry, the relationship between utilities and the state, the financial position of the utility as well as the scale of the requirements. Financing is an area where it is not uncommon for government, utilities, development agencies and the private sector to be involved. Lastly, implementation and operation would almost always be a utility function, although the nature of these activities would depend on industry structure.

There is some debate concerning the advisability of establishing a separate utility to tackle electrification, and in particular rural electrification projects. In Thailand, the utility concerned was an entity entirely responsible for distribution in non-metropolitan areas of the country, with minimal generation or transmission responsibilities, or any involvement in the rapidly growing Bangkok metropolis. In Ireland, the national utility created a special division within itself to deal with electrification projects. A number of countries, for example Bangladesh and the Philippines, have attempted to follow the US model of rural electrification cooperatives, supported by state finance. However, these have not always been successful and in some countries cooperatives have been short lived, generally being taken over by a larger utility. Countries such as Greece and Korea have tasked the national utility with implementing electrification programmes, with apparent success. In other countries where a single national utility does not exist, and distribution is handled by a number of separate utilities, it hardly seems appropriate to fragment the industry still further, and this has rarely happened. In these

cases the trend has been to establish some sort of national coordinating body (REC in India and GEER in Brazil) in order to promote electrification projects.

Almost all large scale electrification programmes have relied on (1) government financial resources and (2) cross-subsidies from urban consumers. In some cases government financial support has been in the form of direct grants, as in Ireland, where policy was to provide 50% of capital costs from the national treasury. In other cases government financial support has been in the form of low interest loans (as in India and Korea), or guarantees on concessionary finance (as occurred in Thailand). Cross-subsidies from urban consumers have been an essential part of virtually all successful electrification programmes. In many cases these cross-subsidies have occurred within a single national distribution utility, and hence have been easy to implement but difficult to monitor. In other cases, where separate institutions have implemented electrification programmes, other mechanisms have had to be found. In Thailand, the urban-rural subsidy came in the form of different bulk tariffs to the urban and rural distributors. Even where financial transfers such as these have been arranged, there has been pressure on a distributor to build up its revenue base as quickly as possible. This reduces the relative significance of cross-subsidies as well as easing access to further financing.

In some cases, electrification programmes have led to high tariff increases (as in Korea), although in other cases the opposite has occurred, with government refusing to allow tariff increases in an attempt to contain inflation and hold down industry input-costs and household expenses. In fact, the World Bank has identified this control on tariffs as being one of the contributory factors to the deterioration in financial and technical performance of many utilities in developing countries (Schramm 1993).

Not all countries have attempted to produce national master plans. Thailand is an example where a national plan was developed at the outset of the programme and used as the basis of electrification thereafter. Barnes (1995) suggests that the existence of this well-structured and feasible plan enhanced the ability to raise adequate finance from multilateral and bilateral agencies. In other cases electrification has been largely demand-driven, with long-term planning concerned with the establishment of procedures on how to select projects. Examples of this approach have occurred in Korea and Ireland. In the case of Brazil, the existence of a fragmented distribution industry with a complex governance system meant that electrification has occurred in a piecemeal and uncoordinated fashion. The usefulness of masterplans and the capacity to produce them is probably related to the type of political system. Where a country is structured as a federation of states (as in Brazil and India), it is much harder plan at the national level. In other countries where there is a strong central government, as in Korea and Thailand, national control over planning and implementation is easier. In small countries, such as Ireland and Greece, national planning is easier given the relatively reduced scale of the task.

Project selection procedures have generally been designed to ensure that least-cost and high-revenue settlements receive higher priority. The rationale for doing this has been to minimise the negative financial impact on utilities, and to maximise the benefits of investments in electrification. The Zimbabwean example shows how an attempt has been made to identify potential 'growth' sites in order to prioritise electrification projects. It is reasoned that if such sites can be identified, then the positive economic spin-offs associated with electrification will be maximised. In countries where the interaction between the implementing authority and communities has been important, for example in countries where cooperatives have been used, or in Ireland where the rejection of the programme was a possibility, selection and prioritisation has generally been influenced by the need to address this.

The principle conclusion of this review is that electrification planning is closely associated with the institutional structure of the electricity supply industry. Options for government policy, planning procedures, financing arrangements and implementation strategies have to be seen in the context of the prevailing institutional structure.

## **2. Country case studies**

This section presents very brief descriptions of a number of countries' electrification programmes. In most cases only a certain aspect of the programme is covered, although in some cases, such as Korea and Thailand, a more complete description is given.

The first two case studies are of Thailand and Korea - two East Asian countries with very rapid and successful electrification programmes. The following two cases are of Brazil and India, both countries with a federal political system and a fragmented electricity supply industry with separate utilities in each state. The Bangladesh example presents a case where rural electricity cooperatives have been used, attempting to follow the model presented by the United States. For comparison, a brief description of the US example is also presented. Greece and Ireland are two relatively small and less wealthy European countries where electrification has been the responsibility of a national public utility. Both present examples of how government has used these public bodies to implement national electrification policies. Lastly there is a presentation of Zimbabwe's attempt to rank electrification sites on the basis of their potential to contribute to economic growth.

### **2.1 Thailand - a nationally planned electrification programme**

Thailand implemented an accelerated national electrification programme over the period 1977 to 1991. During this time the level of access to electricity outside of the Bangkok Metro area rose from 17% to 80%. Almost all villages were connected to the grid during this period.

The key elements of Thailand's electrification programme can be summarised as:

- the development of a comprehensive national plan,
- appropriate institutional arrangements,
- financing arrangements designed to promote cross-subsidies and to ensure the financial viability of the rural electrification agency, and
- political support for the programme.

Figure 1 presents the institutional configuration of Thailand's power sector. There is one agency responsible for all generation and transmission - the Electricity Generating Authority of Thailand (EGAT). Two distribution authorities purchase electricity from EGAT: the Metropolitan Electricity Authority (MEA) is responsible for electricity supply within the Bangkok metropolitan area; and the Provincial Electricity Authority (PEA) is responsible for distribution to provincial towns and rural areas. All three authorities are publicly owned, and the electrification programme enjoyed full support from the government and the King.

The establishment of MEA as a distribution authority without responsibilities for generation and transmission, or for distribution within the rapidly growing Bangkok metropolitan area, meant that MEA could focus its attention on the electrification programme.

Before any electrification projects were undertaken, a national plan was developed and a feasibility study conducted in collaboration with international consultants (from USAID). This plan was divided into five stages, each of five years duration and each targeting a specific region of the country. The first stage was targeted at the more economically and politically backward north-east region. The stages were later designed to overlap in order to accelerate the implementation of the programme. These five year plans were integrated with the successive National Economic and Social Development Plans (Dingley 1988).

The national plan contained details for managerial, technical and financial requirements; criteria for designating priority areas and selecting villages; load promotion and pricing policy as well as implementation, operation and maintenance standards and procedures.



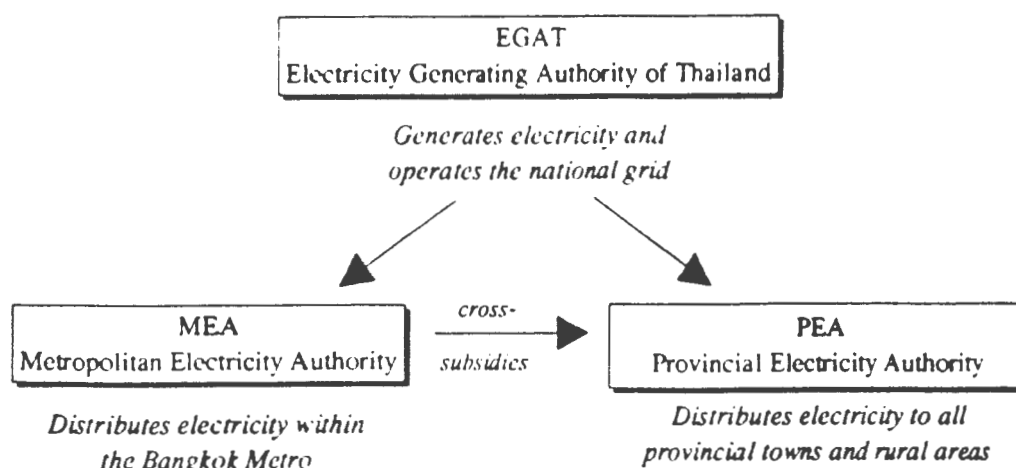


FIGURE 1 Institutional configuration in Thailand

Village selection policies were based on the precept that more economically developed localities should receive higher priority. The rationale for this was that these places would make more use of electricity, and so the benefits and revenue generated would be greater. Each province was assessed on the basis of a set of 26 socio-economic variables, and a composite score obtained for the province. This was then used to decide the extent of electrification to achieve within each province. Once the number of villages to be electrified had been established, villages were prioritised on the basis of six key variables: (1) proximity to the existing distribution system; (2) access to roads; (3) village size; (4) load potential; (5) number of commercial establishments; and (6) number of public facilities.

Stage	Period	Targeted villages	Accumulated villages	Area
1	1977-81	5 200	5 200	North East
2	1980-84	8 000	13 200	South
3	1983-87	13 500	26 700	North
4	1986-90	14 500	41 200	Central
5	1989-91	5 800	47 000	Countrywide

TABLE 1 Thailand's National Plan for Rural Electrification

Source: Tuntivate &amp; Barnes 1995

Adjustments to this prioritisation were then made on the basis of technical considerations, and villages excluded from the selection would be included if the residents were prepared to pay for a portion of the capital costs. In practice the electrification programme comprised of three types of projects. In the standard case PEA paid for all capital expenditure and villages were selected and prioritised in the normal way. Secondly there was the contribution scheme where villages prepared to pay for 30% of the capital costs would be electrified much sooner than otherwise. Lastly there were cases where villages paid for the full construction costs and these received top priority.

PEA was required to operate as a financially viable enterprise. In practice this was achieved through four mechanisms:

- The prioritisation of low cost and high revenue villages in order to build a substantial revenue base as soon as possible. Aggressive load promotion and marketing strategies were adopted by the utility.
- The use of cross-subsidies from urban consumers and higher consuming rural consumers. Cross-subsidies from PEA customers were facilitated through internal transfers (it should

be noted that PEA supplied all urban centres outside Bangkok); and subsidies from the Bangkok Metro were made available through a mechanism whereby PEA paid 30% less than MEA for bulk supply.

- The use of concessionary loans from bilateral and multilateral agencies - approximately half of all funding was on concessionary terms. Since PEA was a state corporation, these loans were guaranteed by the Thai Government (World Bank 1992).
- The use of strategies to reduce costs, and the contracting out of revenue collection to local leaders.

Pricing policy was to apply uniform tariffs, approved by the Government, throughout the country, to both PEA and MEA customers. All tariffs were inclining block tariffs designed so that the average price was close to the long-run marginal costs of supply. Monthly consumption below 35 kWh was charged at a 'life-line' tariff.

## **2.2 Korea - electrification planned by central government**

In 1965 the Korean government passed an 'Electrification Promotion Law' which set out, in detail, the procedure for extending electricity supply throughout the country. At that time only 12% of the population had access to electricity. Ten years later this had risen to 75%, and by 1980 over 99% of the population had an electricity supply.

Korea is probably unique in both the pace of the national electrification programme, and the extent to which electrification planning procedures were laid down by law. The Electrification Promotion Law consisted of 23 articles dealing with, among other things, project selection procedures, financing, responsibilities of the public utility (KEPCO<sup>1</sup>), local and national government, planning, budgeting, implementation and operational procedures.

Financing is shared between local government, central government and KEPCO. Customers are expected to pay a small portion of the connection costs and this is limited to less than R500 per customer. A long-term loan from the government accounts for the bulk of the costs, and this is limited to R5 000 per customer. The loan is repaid over 30 years, with a five year grace period. Any remaining costs were meant to be split between central government, local government and KEPCO in the proportion 25:25:50. However, it appears that in most cases KEPCO covered all remaining costs and no grants were forthcoming from central or local government. It is only after 1983, when projects were situated in remote localities that were expensive to electrify, that government began to contribute substantial grants to the programme. Figure 3 presents the costs for the programme. KEPCO recovers its investment through the tariff, and this led to large tariff increases during the 1970s when much of the electrification programme was being implemented. Since KEPCO is the national monopoly utility, cross-subsidies from existing consumers could be used to cover losses.

A distinction is made between settlements on the mainland, which can be connected to the national grid, and island settlements where local grid networks are necessary. In the former case, KEPCO takes primary responsibility for most of the planning, implementation and operation of the project. In the latter case, the local government manages the project, with technical support from KEPCO. Since procedures for mainland and island sites are different, it is worth describing each case in turn.

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<sup>1</sup> KEPCO used to be a completely state owned utility. Some 15% of the stock is now privately owned.

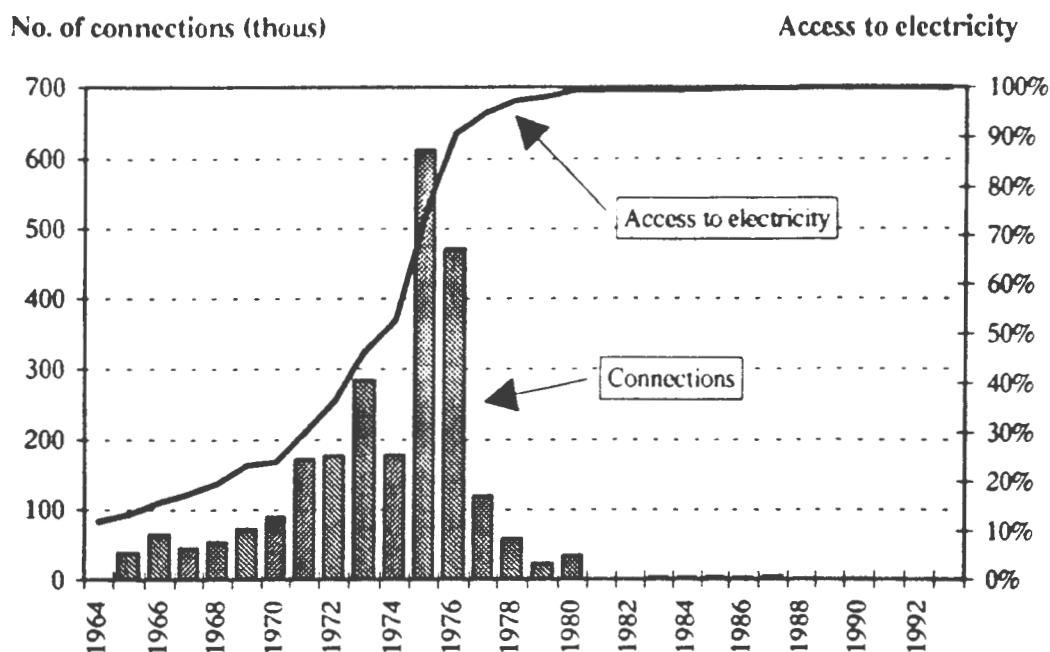


FIGURE 2 Progress of Korean electrification programme

In cases where the project is to be connected to the national grid, KEPCO assumes primary responsibility for the project. Planning is conducted on an annual basis: applications from local government must be received by KEPCO 12 months before possible project initiation. This allows financial planning for the following year to be conducted, i.e. for KEPCO, local government and central government to include the electrification project in their next year's budget. The Ministry of Commerce, Industries and Resources (MCIR) plays a central role in this planning process and is responsible for approving the final plan for each 12 month cycle. The Ministry adopted a policy of selecting projects in order of least cost, thus ensuring that the distribution network grew incrementally with each project.

The government loan is provided to new customers, but is administered by KEPCO. The monthly electricity charges include pro-rata repayment of the loan, and this must be repaid by KEPCO to the government on a quarterly basis. All risk for the loans is carried by the government.

In cases where the project is located on an island, the policy is to provide local generating facilities and to utilise a local grid network. In these cases local government assumes primary responsibility, and KEPCO provides technical, managerial and financial support. Applications for supply are received by the MCIR which then compiles the annual plan. Financing arrangements are the same as for mainland distribution projects, with the exception that the government loan is administered by local government rather than the utility. Although local government is responsible for the construction, maintenance and operation of the project, it is possible for these activities to be subcontracted to agents. KEPCO has the responsibility of providing technical support if required, and in cases where there are 500 or more customers, can undertake to operate the system. If there are operating losses on the project, that is, a shortfall between costs and revenue (excluding revenue earmarked for loan repayments), KEPCO is required to cover 75% of these losses. This mechanism ensures that cross-subsidies available for mainland projects are also available for island projects.

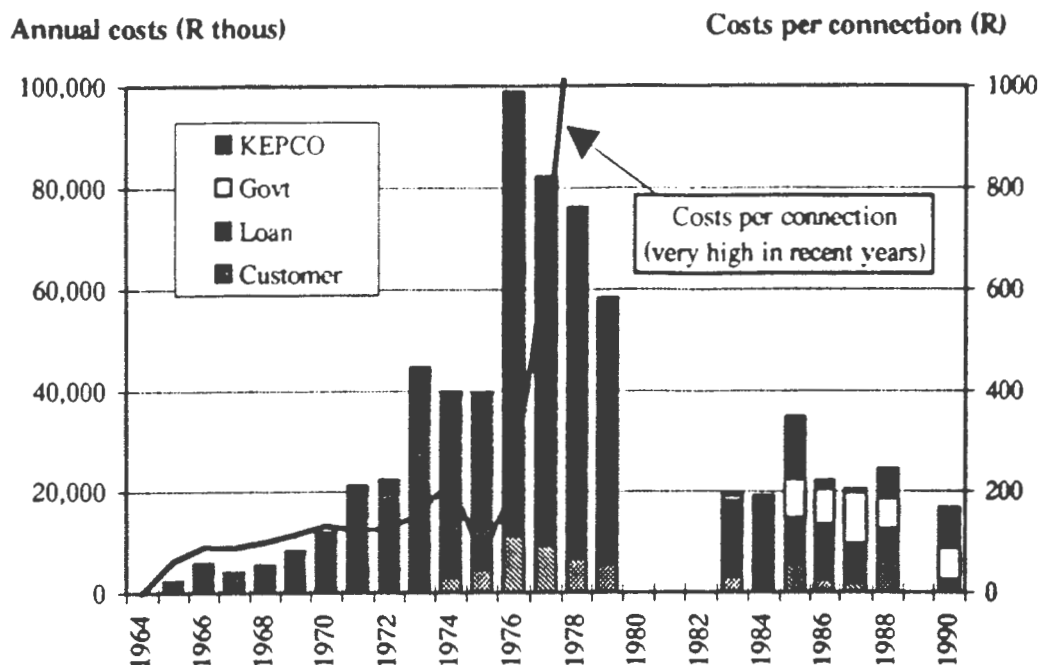


FIGURE 3 Costs of Korea's electrification programme

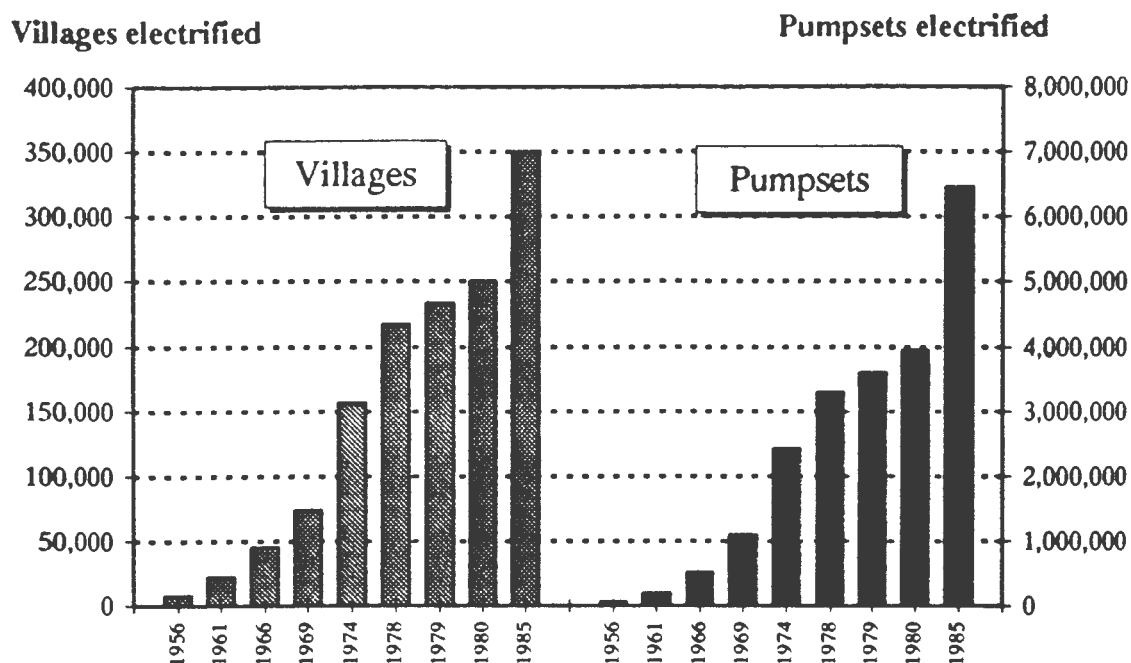
In recent years electrification costs have been exceptionally high. This is because the remaining unelectrified settlements are extremely costly to reach. In these cases, the bulk of the costs have been covered by government grants.

Korea's successful and rapid electrification programme must be seen in the context of the rapid economic growth which Korea has experienced during this period, and the commitment of the military government to achieving full electrification. The first point has meant that the programme has been affordable - cross-subsidies from the rapidly developing urban centres have supported KEPCO's operations and real incomes have risen, making electricity an affordable commodity to many households. The high priority which the government gave to mass electrification ensured that sufficient funds were available, and at concessionary rates.

### 2.3 Rural electrification in India - the rationale of irrigation pumping

India's rural electrification programme is one of the most widely known case studies in the world. Part of the reason for this lies in the focused targeting of rural electricity for irrigation purposes. This specific objective must be seen in the light of the 'green revolution' in which certain areas were identified for intensive investment in new agricultural technologies.

In 1969 the Rural Electrification Corporation (REC) was established as a national body tasked with the responsibility of coordinating and supervising rural electrification. It provides financial assistance to state electricity boards and rural cooperatives, and determines the conditions of these loans.



**FIGURE 4** Rural electrification achievements in India

Although India has invested massively in its electrification programme, there have a number of notable criticisms. Firstly, the programme has been heavily subsidised in order to promote the use of electricity for water pumping. Although this means that farmers have benefited from low cost inputs (in the form of cheap power), studies have pointed out that the benefits of diesel pumping equal those of electric pumps, yet the economic costs are often lower (Barnes 1988). Financially stretched utilities have been unable to provide sufficient capacity to meet demand growth, resulting in poor reliability in many rural areas. It is not uncommon for farmers to use a diesel pump as back-up to their subsidised electric system.

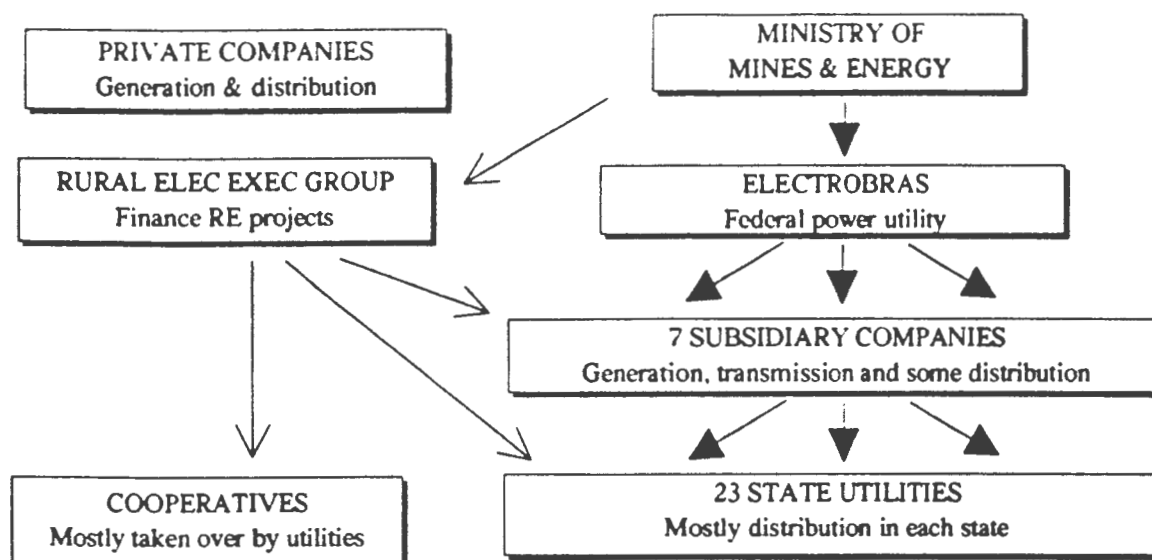
The focus on electrical power for irrigation has tended to lower the priority given to household electrification. Although more than 60% of all villages have access to electricity, it is not uncommon for actual take-up rates to be in the region of 10-20% and household access remains low.

The planning mechanism has involved the adoption of five year plans, each with a set of electrification targets. The World Bank (1986) has commented that 'more emphasis seems to be given to meeting centrally-established targets for village electrification than to expanding power use.'

## 2.4 Brazil - unstructured electrification planning

Brazil is the world's fifth largest country in terms of area, with the sixth largest population. It is also among the world's ten largest economies. Rapid economic growth in the 1960s and 1970s was curtailed during the 1980s - the 'lost decade' for much of Latin America - when the debt crisis and high inflation served to slow down the economy.

The political system is a federation of 23 states, and the current structure of the power sector reflects this. Eletrobras is the federal public utility, created in 1961 to take responsibility for the development of Brazil's power sector (De Oliveira 1993). There are also public utilities in each state, which take primary responsibility for distribution (although some also own generation plants).



**FIGURE 5** Institutional structure in Brazil

Rural electrification projects were initiated in the mid-1960s by the federal government and led to a programme of establishing rural power cooperatives. In 1971 the ministry set up the Rural Electrification Executive Group (GEER) to arrange for the financing of electrification projects. Funds were raised primarily from the government and foreign lending agencies. In the late 1970s the Ministry embarked on its own electrification projects through Eletrobras, and about the same time many state utilities began electrification projects in their own areas, particularly in the wealthier states (Dingley 1988).

Although these unstructured programmes have been relatively successful in some states, electrification has been uneven through the country, with poorer areas making the slowest progress. Although the federal Ministry takes an active interest in electrification programmes, there is no institutional mechanism whereby national electrification planning can occur.

## **2.5 The United States - the use of rural cooperatives**

The use of rural cooperatives to further electrification is best demonstrated by the experience in the US. The American example has inspired a number of countries to adopt this model (with encouragement from the umbrella body of US cooperatives, the NRECA), with varying degrees of success. The Philippines is an example where rapid rural electrification has been achieved, much of it through the use of cooperative structures (Santos 1990). However, political pressure in this country has encouraged over-ambitious projects and kept tariffs low, resulting in financial difficulties for the National Electrification Administration, as well as for a number of cooperatives (Foley 1992). Bangladesh has also followed the US system, evidently with considerable success, and this is dealt with in the next case study. Attempts in other countries have not always met with the same promising results (Foley 1992).

Widescale rural electrification was initiated by President Roosevelt in 1935 when the Rural Electrification Administration (REA) was established. The REA was the administrative body which dealt with government loans to rural electrification projects (later extended to rural telephone systems). Initially an annual amount of US\$ 40 million was apportioned by the state to the REA and loan rates, at this time, were based on government long-term debt and repaid over 25 years. Although private and state utilities could qualify for loans, cooperatives soon became the principle vehicle for organising new supplies. Nye (1990) points out that in the early years there was some conflict between the new cooperatives and private utilities, who on occasion resorted to 'snake lines' - distribution lines which quickly reached the most profitable consumers in a rural area, thereby pre-empting any attempt by a cooperative venture to provide 'area coverage'<sup>2</sup> supply.

Cooperatives were actively encouraged by the REA and were specifically excluded from regulation by state commissions (REA 1966). In 1942 the National Rural Electrification Cooperatives Association (NRECA) was formed to represent the interests of the cooperatives. In 1944 the pace act was passed which lowered the interest rate on loans to 2% (compared with 2.5% to 3% over the previous ten years) and extended the repayment period to 35 years. After the second world war, annual allocations from the state increased six-fold to US\$ 250 million and by 1957 some 95% of all US farms had been electrified.

The experience in the US is often presented as an example of how electricity supply to rural areas can result in agricultural-productivity improvements associated with the use of mechanised equipment. However, Foley (1990) points out that US farmers were considerably wealthier than most rural residents in developing countries today, and so electrical appliances, machinery and electricity bills were more affordable. In addition, it took a long time before average consumption rates reached the level at which electricity was being used to power agricultural equipment on a widespread basis. In 1942 average electricity consumption in rural areas was 50 kWh per month and ten years later was still at only 150 kWh per month (REA 1966). By 1965 this had tripled to 450 kWh per month.

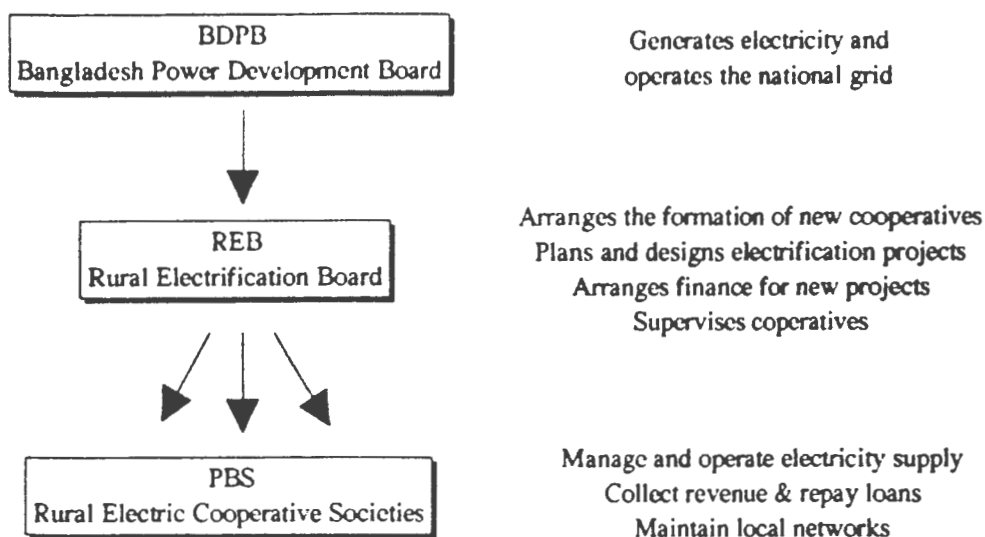
Although much of the US power industry is comprised of privately-owned utilities, it is noteworthy that the rural electrification programme was dependent on (1) direct intervention by the state to initiate the programme, (2) consessionary state loans, and (3) the use of non-profit cooperatives to implement electrification projects.

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<sup>2</sup> Area coverage refers to the principle whereby all potential consumers in an area are supplied with electricity. In 1950 this principle was made a condition of REA loans.

## 2.6 Institutional arrangements in Bangladesh - following the US model

Bangladesh ranks as the second poorest nation in World Bank statistics. It suffers from frequent natural disasters - given that the country is extremely flat, annual floods often cover more than 40% of the land. Road and rail transport is extremely difficult due to the many river crossings. Bangladesh is also the most densely populated country in the world - a total population of over 100 million with an average density of 730 people per square kilometre.



**FIGURE 6** Institutional structure for rural electrification in Bangladesh

The country's rural electrification programme (over 90% of the population live in rural areas) is based on the US model of area coverage supply through user cooperatives. In 1977 the Bangladesh Government established the Rural Electrification Board (REB) which was given the task of providing electricity in rural areas. This public entity purchases power from the national utility (BPDB) and distributes it to rural electricity cooperatives. Each cooperative covers a population of 500 000 to 1 500 000 and has full responsibility for the operation, management and finances of electricity supply in its area. The cooperatives are run as non-profit associations and are allowed to set their own tariffs. Any rent associated with electricity supply is thus transferred back to consumers in the form of lower tariffs.

During the first ten years of its existence the REB facilitated the establishment of some 37 cooperatives supplying 312 000 connections. Given that a customer is allowed to sell electricity on to neighbours, the total number of rural households with access to electricity is in the region of 600 000; with a further 47 000 shops and 10 700 irrigation pumps also supplied (Foley 1990). Given the density of the population, average costs per connection are relatively low with a minimum of 75 customers per kilometre of line.

The financing of rural electrification is based on concessionary loans from the Bangladesh Government and foreign grants. Approximately 60% of total costs have been supplied by donor countries (covering the foreign exchange component of the costs), and the remainder is loaned to cooperatives at low interest loans over 30 years.



## **2.7 Ireland - state supported rural electrification**

Ireland commenced its electrification programme in 1946, at which time 60% of the population of 2.9 million people lived in rural areas. Although the countryside was dotted with small villages, much of the rural population lived on isolated farmsteads spread across the countryside. At the start of the programme, the total generating capacity was small (175 MW), yet a reasonably extensive grid connected all the main urban centres as well as many of the smaller towns.

The Irish Government identified rural electrification as a mechanism to address rural poverty and requested the Electricity Supply Board to prepare plans for an extensive electrification programme. In response, the Board established a separate division to plan and implement rural electrification - the Rural Electrification Office (REO). By 1976 rural electrification was officially complete with virtually all households connected to the grid. Over the thirty year period a total of 506 000 new connections had been made.

Key features of the electrification programme in Ireland included the following:

- A 50% capital subsidy from the Government. In fact, this subsidy was withdrawn at times when national finances could not afford it.
- The establishment of a division within the national public utility tasked with the full responsibility of planning and implementing the programme.
- Close interaction with rural communities and the contribution of voluntary non-government agencies. There was a strong focus on promoting the use of electricity on farms and in homes.

## **2.8 Greece - electrification by one national utility**

There is a single power utility in Greece - the Public Power Corporation (PPC). It was formed in the early 1950s with the intention of rationalising the electricity supply industry under one public body. At the time of its formation, only 7% of settlements in Greece had access to electricity - over 90% have now been electrified.

The development of PPC followed three phases:

- The creation of centralised and more efficient generation facilities
- The take-over of distribution from the many small private companies which supplied towns and cities in Greece. In 1956 PPC was given the exclusive right to distribute electricity, and by 1965 had upgraded and extended the urban distribution systems.
- The extension of electricity supply to rural areas. The rural electrification programme was initiated in 1965 and virtually completed by 1988.

Governance of PPC is effected through two bodies: the board of directors (six directors are appointed by government and three are elected by employees); and a stakeholder council representing government, PPC management and staff, local government and civic organisations.

Electrification planning was based on a project selection plan, updated every two years to reflect progress made and changes in priorities. Selection policies were guided primarily by settlement density, although special priority was given to irrigation projects. Government also played a role in selecting settlements based on 'social factors'.

Financing of the programme was covered by retained earnings, as well as foreign and local loans. As a public corporation, all loans were underwritten by the government. Over the five year period 1983 to 1987, PPC connected some 600 000 customers at a cost of R2.1 billion, equivalent to R3 500 per connection (Dingley 1988). As a single national utility, PPC is able to utilise cross-subsidies from urban consumers to cover losses from rural consumers.

Domestic tariffs are inclining block tariffs, designed to allow life-line rates as well as encouraging conservation. The lowest block, valid for the first 50 kWh per month, is still higher than PPC's average costs. Average domestic consumption is in the region of 160 kWh per month. Although PPC has the right to disconnect non-paying consumers, there is public and political pressure not to do this.

In addition to PPC's rural electrification programme the Ministry of Agriculture has operated, in conjunction with PPC, a special farm electrification programme. This has a particular emphasis on supplying electricity to livestock farms. In general these are non-residential holdings, with farmers residing in nearby villages. There are approximately 90 000 of these unelectrified farms (compared with 30 000 remaining unelectrified homes), and the Ministry aims to connect 6 000 of them per year. Costs are shared between PPC (43%), the Ministry of Agriculture (29%) and the farmers (28%). Farms with a higher revenue potential are prioritised, and these farmers are expected to pay a smaller portion of the capital. Costs to date appear to be in the region of R20 000 per farm.

## **2.9 Rural electrification planning in Zimbabwe - identifying settlements with a high growth potential**

At independence the government of Zimbabwe inherited a spatially and economically divided country. On the one hand there were the cities and towns, where well established manufacturing and commercial activities existed. These centres were economically linked to the wealthy commercial farming districts. On the other hand there were the scattered and impoverished subsistence farming areas, which lacked adequate physical and social infrastructure.

In response to these inequities, the government adopted a strategy of extending public administration, commercial services, physical infrastructure and community facilities throughout the country - a policy of 'growth with equity'. In order to facilitate the most cost-effective allocation of resources within this investment programme, a hierarchy of rural settlements was established whereby localities were ranked according to their economic growth potential. At the top of the list were designated 'growth points' and 'rural service centres' - deemed to represent the greatest potential for rural economic growth and accessible to rural populations of between 10 000 and 50 000 people. Ten years after the adoption of this classification system it was clear that not all the designated growth centres were actually growing; and that many centres which had grown did so as a result of the expansion of the public sector rather than any increase in productive economic activity. In cases where settlements had failed to 'take off', the government found itself in the position of having invested in under-utilised physical infrastructure. Conversely, some centres had achieved rapid growth despite being relatively low on the priority list and consequently having received only secondary priority for investment resources.

A reassessment of this classification system concluded that the essential ingredients of a 'growth point' were (1) the existence of at least one productive enterprise, marketing produce to other areas; and (2) an active hinterland providing the necessary primary inputs for the productive activities in the centre. It was also concluded that the only essential element of public infrastructure was water provision. Other services such as electricity, while greatly improving the quality of life, should be regarded as facilitators rather than generators of economic growth. Bearing these points in mind, a new hierarchy of rural settlements was proposed, ranging from high growth centres to stagnant or declining areas:

- **Group 1: High growth centres with high population**  
Average population of 6 400 people, growing at an estimated 6% - 9% per annum.

A productive economic base and economically active and supportive hinterlands.

- **Group 2: High growth centres with medium population**  
Average population of 1 400 people, growing at an estimated 7% per annum.  
A productive economic base and economically active and supportive hinterlands.
- **Group 3: Active commercial centres with high population**  
Average population of 1 850 people, growing at an estimated 3.7% per annum.  
Limited manufacturing base, but with an active commercial sector.
- **Group 4: Active commercial centres with medium to low population**  
Average population of 1 010 people, growing at an estimated 2.7% per annum.  
Limited manufacturing base, but with an active commercial sector.
- **Group 5: Service/administrative centres**  
Average population of 300 people, growing at an estimated 2.7% per annum.  
A focus for public sector such as schools, clinics, administration etc.
- **Group 6: Stagnant or declining centres**  
Average population of 170 people with continual out-migration.

An investigation into the success of rural electrification projects in rural settlements found that supply-side costs tended to dominate demand-side factors in determining the results of any financial or economic analysis. Despite this, it was noted that some remote settlements with high growth potential had benefited greatly from the supply of electricity (coordinated with other services). It was thus concluded that financial and economic criteria are inadequate in selecting electrification sites: in addition the growth criterion, based solely on demand considerations, should be utilised. It was felt that the 'growth classification' outlined above was an adequate tool to introduce these considerations into electrification planning (Robinson 1991).

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# **Key Issues in Electrification Planning**

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**Mark Davis**

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**EDRC  
September 1995**

## 1. Introduction

This document is an attempt to outline some of the key questions facing the electricity supply industry, and which would have to be considered in any form of scenario planning for the industry. Many of the issues require detailed policy formulation in support of regulation, and all have implications for the structure and operation of the distribution industry.

## 2. National electrification planning - resources and institutions

There is no national institution capable of coordinating and planning a national electrification programme. At present, electrification planning takes place within each distribution agency, with Eskom assuming responsibility for the bulk of annual targeted connections. Many municipal distributors have embarked on electrification programmes and in-house planning is conducted. However, there is no over-all national coordination of these activities, and no mechanism to ensure that the targets set by the RDP will be met. Eskom dominates electrification planning and the implementation of the programme, but has no jurisdiction in regions outside of its supply areas. The NER is possibly in a position to fill this institutional vacuum, but at present has little capacity to monitor progress or embark on detailed electrification planning.

Part of the problem relates to the inadequacy of resources to support electrification planning. Despite improvements over the past few years, there are large data inadequacies for many areas of the country. Although Eskom is embarking on initiatives to refine the state of demographic and electrification data, these efforts are likely to concentrate on Eskom's areas of supply. It will be some time before these data resources are developed to a stage where accurate supply-side and demand-side information is available for the many municipal distributors around the country.

## 3. Electricity supply and local government

The financing of municipal services is intimately bound up with electricity distribution. NELF proposals call for a reform of the system whereby electricity surpluses are paid into the general rates account. Although it is recognised that these surpluses are a critical part of local government finances, transfer mechanisms should be made as transparent and equitable as possible. If distribution operations remain to remain with municipalities, NELF has called for the transferred surplus to be set at a fixed percentage of turnover. If distribution is taken away from municipalities, other arrangements may have to be made.

The interim constitution tasks local government with the duty of supplying electricity to residents, within the bounds of practicality and financial viability. Although this does not necessarily imply that local government operate electricity distribution, it does mean that local government has the right to participate in, and possibly control, electricity supply within its area of jurisdiction.

## 4. Competition and third party access - the special case of large users

The principle of area-based monopoly supply rights means that all customers within an area are supplied by one authority. However, there are precedents for large users to be supplied directly by Eskom, even if the user lies within another distributor's supply area. Although it is quite likely that the NER will allow these customers to continue to be supplied by Eskom, it is unclear to what extent other large users will be able to choose their supplier. The danger of allowing the status quo to continue, without provision being made for other users to also opt for a direct Eskom supply, is that it fixes relative input cost advantages for industry. This distortion may carry a penalty for the development of South African manufacturing and industry.

In most cases, and given a choice, large users would choose to be supplied by Eskom, rather than the local authority's electricity department. However, as the structure of the industry changes, it is possible that competition between different distributors may become possible. If

any such competition is to be allowed, it requires acceptance and regulation of general principles governing third party access.

Lastly, if competition is allowed in the large user market, it will have implications for the revenues of municipal distributors. Should these distributors lose their larger customers, their ability to raise capital as well as utilise cross-subsidies for electrification projects may be threatened.

## **5. Efficiency in the distribution business**

It is apparent that many municipal electricity departments are inefficiently operated. Not only are existing customers paying for this in terms of higher tariffs, but potential customers also pay a penalty in the form of lower levels of access to electricity.

Mechanisms must be found to promote efficiency in the distribution business, without unduly disrupting the electrification programme. Efficiency incentives are notoriously difficult to implement in monopoly businesses, particularly so when the industry is highly fragmented. The rationalisation of the distribution industry may make such incentives easier to implement and regulate, but rationalisation in itself is an inadequate means to promote efficiency.

## **6. Private participation**

In many developing countries there have been attempts to introduce private participation in the electricity supply industry. In many cases this has been a consequence of the need to attract capital into new generation projects, although in some cases it has been part of a programme to improve the efficiency of the industry. Although there are many other forms of private participation, privatisation of some or all of the South African industry has not been ruled out by the Government. Eskom, as a well run and profitable enterprise would represent an attractive investment (although the costs of the electrification programme may discourage some investors).

Generation is probably the easiest part of the electricity supply industry to attract private participation and promote competition. However, there are also options in the distribution industry. Distributors can compete with one another if third-party access is guaranteed. However, in the small-user market this type of competition is harder to implement. The use of contracting-out and the granting of fixed length franchises are also options which can be used to promote competition and improved efficiency. Already there are some examples of distributors contracting-out specific services such as first-line maintenance and network planning.

If private participation in the electricity supply industry is to be contemplated, then this has implications for both the structure of the industry and regulation of the industry.

## **7. Financing electrification - capital, grants and cross-subsidies**

Electrification is capital intensive. Els (1994) estimates that the cumulative net financing requirement (inclusive of capital expenditure, finance charges, operating losses and net of cross-subsidies) of the electrification programme in 2000 will be R6.5 billion. Approximately one third of this will have to be raised by non-Eskom distributors.

Eskom, through its treasury, has access to relatively cheap forms of credit and is able to raise finance through the bond market. Smaller distributors do not have access to such markets and have a smaller asset and revenue base to use as collateral. In many cases, the capital investment demands of electrification far exceed a local distributor's financial resources. Although the DBSA offers concessionary loans for electrification projects, the total amount available is limited. Also, the Bank would be reluctant to make loans to an institution that it judges unable to afford loan repayments.

NELF recommended that Government financially support rural electrification. Eskom has also supported this recommendation in a number of policy documents. The cost per connection of supplying electricity in rural areas is often more than double that in urban

areas, and the revenues are generally lower. However, to date government has indicated that it is not willing to provide any finance towards electrification projects, and has called for the electricity industry to fully finance the electrification programme. The availability of government funds in support of electrification projects will affect the pace and scope of the programme.

In most cases revenues from electrification projects are inadequate to ensure an adequate financial return on the investment. In some cases, revenues do not even cover operating costs. At present these costs are covered through cross-subsidies from other domestic customers as well as non-domestic customers. If cross-subsidies are contained within each local distributor, then they can serve to exacerbate inequities. To illustrate, in order to cover electrification project losses, a distributor with a predominantly domestic customer base would have to charge higher tariffs than one with a more diverse set of customers. The situation is made worse if smaller distributors have a larger backlog of unelectrified households.

If cross-subsidies are to be part of an electrification policy, then their use should be both transparent and equitable. This requires mechanisms to transfer subsidies from one region to another.

## **8. Pricing policy and domestic tariffs**

One of the unresolved proposals made by NELF was the implementation of a national domestic tariff structure and level. Although the NER is in a position to regulate and approve tariff increases, it is unclear to what extent this function will be exercised. The imposition of such a national tariff system, with provision made for 'life-line' tariffs to low income consumers, has obvious equity benefits as well as having an impact on the revenues of local distributors.

## **9. Demand side management and energy efficiency**

Domestic electricity loads have relatively low load factors, thus they contribute disproportionately to the peak demand on the system. Since the cost of electricity generation is significantly higher at peak times, the average cost of supplying domestic customers is high. As the peak begins to approach Eskom's installed capacity limits, the incentives to manage electricity demand and to promote energy efficiency will increase.

Eskom has recently adopted an 'integrated electricity planning' approach in order to combine demand and supply interventions in a least cost strategy. It should be noted that the implementation of demand side management strategies is made that much harder where the distribution industry is highly fragmented.

## **10. Technology choice - the option of off-grid technologies**

Eskom is currently investigating the use of lower cost technologies and alternative technical standards, particularly for rural networks. Of particular importance is the proposal to use limited load supplies. Current breakers may either be implemented with metering, or combined with the use of flat rate tariffs. The advantages of limited load systems are firstly that they lower the capital cost through the use of weaker networks and possibly the absence of expensive metering technology; and secondly because new customers on these systems impose a smaller burden on the national peak. These proposals directly affect the level of service provision and will be of concern to the Regulator as well as communities affected.

If limited load systems are to become a feature of electrification, then the question of solar home systems becomes particularly important. Not only are these systems lower cost for particularly remote and isolated communities, but they provide a similar level of service as limited load grid supplies. However, the implementation, financing and institutional arrangements for solar systems are likely to be different from grid supply and their wide-scale use will add a further dimension to the electricity distribution industry in rural areas.



## **11. Conclusions**

The current distribution industry is highly fragmented and there are clear disadvantages to this structure. Firstly, the efficiency of many of the many municipal distributors is generally accepted to be poor. Secondly, the ability of these distributors to finance, implement and sustain ambitious electrification targets is limited. Thirdly, this industry structure imposes limits on the efficacy and fairness of cross-subsidies between consumer groups. Regulation of such a large number of agencies poses its own difficulties, particularly when it comes to ensuring effective interaction with stakeholders.

Despite this rationale, any substantial restructuring of the industry poses its own problems. Firstly there are the large transaction costs associated with any radical changes, particularly in the face of the pressures to implement electrification projects as a matter of priority. Restructuring may well result in a short-term slowing down of the electrification programme. In addition, there is the question of local government finance and electricity sales. It may be necessary to ensure that local governments are compensated if they are to lose the right to distribute electricity. Lastly, any such restructuring will pose new regulatory challenges, which would require the support of an adequate policy framework.

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# Stakeholder opinions on electrification planning

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**Lisa Davidson**

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November 1995

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# 1. INTRODUCTION

National electrification has been identified as one of the Presidential Lead Projects in the RDP and has attracted considerable public debate. Initially policy discussion took place largely under the auspices of the National Electrification Forum (NELF), which has now ceased to exist, and more lately in the government appointed Electricity Working Group and as part of the White Paper drafting process.

Currently the electricity distribution industry (EDI) is governed at two levels: national government (which has largely devolved powers to the Electricity Council) governs Eskom, and local authorities govern the municipal electricity undertakings. Since local authorities are relatively autonomous there is effectively no line responsibility for electrification planning within the South African government. This situation has arisen due to the historical responsibility that local governments have held for electricity distribution, the comparatively recent involvement of Eskom in electrification and the contradictory effects of the Constitution, the Local Government Transition Act, the Eskom Act and the Electricity Act. Although the government has adopted the national target of 2.5 million household connections by the year 2000 there is no means of devolving this target to the local level.

Current indications are that Eskom intends to connect some two-thirds of the annual connection requirements. Local authorities are, however, already showing signs that they will be unable to complete the remaining proportion of the target connections. Should this be the case, remedial action will have to be taken early on in the programme before it becomes too difficult to catch up. Alternatively the national target will have to be revised, at some political cost.

The Minerals and Energy Policy Centre (MEPC), in conjunction with the Energy for Development Research Centre (EDRC) initiated a proposal to the Department of Mineral and Energy Affairs (DMEA) to manage a project which will review current arrangements for electrification planning, with the intention of identifying improved models and policy options. The DMEA proposed that this project be considered for co-funding by the DMEA, the National Electricity Regulator (NER), the Development Bank of Southern Africa (DBSA) and Eskom, all of whom will be key receivers of the project's outputs.

The goal of this project is to build consensus amongst stakeholders as to the most appropriate systems for electrification planning for South Africa.

Specific objectives of this project are therefore:

1. to identify problems within existing electrification planning processes, particularly relating to:

- the development rationale underlying electrification planning decisions;
- the potential for shortfalls below national connection targets; and

- the national distribution of the electrification programme;
1. to facilitate the participation of a wide variety of stakeholders in the process of problem identification and the development of solutions;
  2. to provide an international comparative perspective; and
  3. to ensure a specific focus on rural electrification, in the context of the principles of integrated planning.

The project consists of a central component on Scenario development and consensus building, which is supplemented by a number of support projects, namely:

- Review of electrification to date;
- International comparative study on electrification planning;
- Planning considerations for rural electrification;
- Financial modelling of ESI evolution scenarios; and
- Stakeholder consultation.

This report covers the Stakeholder consultation support project and thus documents the views of regional stakeholders that were obtained during the provincial visits.

1. The purpose of this report is to give stakeholders attending the Scenario Planning Workshop an insight into regional stakeholders views regarding electrification planning and electricity supply industry restructuring..

## 2. METHODOLOGY

The stakeholder consultation support project was undertaken by conducting open-ended interviews with key or typical electricity stakeholders in a number of provinces. Thus far Kwazulu Natal and the Eastern Cape were visited because of their large rural populations and their huge electrification backlogs, as well as the high cost of electrifying these areas.

The stakeholders consulted in these two provinces were chosen to broadly represent their differing views. It was important to get a balance between Local Government, Eskom and the Provincial Government in each province. Discussions were held around three main areas. Under each area a number of specific issues were raised and the interviewees given the opportunity to respond. The specific issues raised were:

### 1. Finance

- The informal transmission tariff Eskom charges its own distributors versus the higher tariffs charged to municipal distributors who also have to undertake electrification.
- The surplus Eskom generates from sales to its customers (including municipalities) which it uses to subsidise its own electrification projects.
- The widespread non-payment of electricity accounts and electricity theft.
- The proposed national electrification fund.

### 2. Electrification planning and control

- The use and relevance of national and local electrification targets.
- The place and need for remote areas power supplies (RAPS) that do not rely on being connected to the national grid.
- Selection/prioritisation of projects and service provision.
- The role of Provincial Governments in electrification planning.

### 3. Institutions

- Local Governments' needs in respect of the EDI (including present electricity profits).
- Possible corporatisation and commercialisation of electricity distribution.
- Service quality with, and without rationalisation.

- The effect of the present system of distributor monopoly supply rights.
- Possible competition in the electricity supply industry.
- The role of the NER.

Clearly, in many cases the issues overlap, for instance, the electrification fund, listed under Finance, may also be associated with Electrification Planning and Control.

### 3. MAIN FINDINGS FROM STAKEHOLDERS

In this section, the main findings from the stakeholder interviews are presented. For every main issue area described above, the stakeholder documents are provided per stakeholder group, namely: Local Government, Municipal Electricity Undertakings, Eskom, and Provincial Government.

#### FINANCIAL ISSUES

##### Local Government

Local Government dependence on the surplus made from electricity sales came through as the biggest worry for all the Local Governments visited. Rory Rioden (Councillor for Port Elizabeth) said : "We have to find a solution for Local Governments finances vs. national money for electricity". Eddie Morton (Town Clerk, Durban) suggested that legislation be created to assure Local Government of an income. He also made it clear that Local Government needs to be dealt with in a responsible manner. Mr Mac Allister (Town clerk of Mooiriver) expressed his concern that the Mooiriver Local Government grading would go down. (This means that his salary will be reduced along with everybody else's in Mooiriver.)

The stakeholders were asked how they would feel about a National Electrification Fund being established, which would enable electricity distributors to acquire funds which could be used for electrification in their area. This suggestion was mostly popular with the various Local Government representatives. Chris Kapp (Town Treasurer, Port Elizabeth) suggested that this fund be managed by the Development Bank of Southern Africa, and that it be ear-marked specifically for electrification. He warned that it should not be used to finance non-payment. Many of the interviewers felt that the surplus generated by Eskom is in fact national money and therefore should be distributed fairly. Eddie Morton expressed a concern that Local Governments which haven't embarked on electrification projects as of yet would get the money, where as those that had done so would see very little of it. John Nash (Member of Parliament) felt that the creation of this fund could facilitate loans for Local Government at a lower interest rate.

All of the Local Government officials and politicians are concerned about non-payment and the effect this has on the progress of electrification. Mooiriver electricity department, in particular, has not been able to take over their Black neighbour town of Bruntville for this reason, currently the Kwazulu Natal Government is supplying in Bruntville and paying Mooiriver's bulk accounts.

Chris Kapp feels that stricter punitive measures should be imposed for non-payment and theft. Gideon Sam (Buffalo Flats Development Forum East London) suggested that education in this regard would help combat this problem.



### Municipal Electricity Undertakings.

The Local Government Electricity Department heads who were interviewed also expressed concern about their dependence on electricity sale surpluses, Harden Beck (Acting Director Engineering Services East London ) explained that East London makes a surplus of R17 million (13%) which is vital for the supply of other services in East London. He said that if this surplus was taken away, the price of electricity for end-consumers would not drop drastically, however the municipal rates would increase dramatically.

All the interviewees commented on Eskom's Transmission Tariffs. Many of them felt that they were paying twice for electrification (by paying towards Eskom's surplus and by having to finance their own electrification projects), because of this they felt that Eskom should make its surplus available to Local Government to support their electrification projects. Howard Whitehead (CEO Durban Electricity) said that:

- a national plan would be required ;
- a national indication of how the funds should be allocated between provinces and urban and rural areas is needed.

Charles Adams (Port Elizabeth Electricity) feels that it would take an Act of Parliament to establish the fund.

Ray Smith (East London Electricity) suggested that electricity distributors get a grant in proportion to their electricity demand. Charles Adams expressed the need for a transparent mechanism to be built into the fund to ensure that the money gets allocated fairly. He also posed the question "Would it (allocation of the fund) be retrospective?" Port Elizabeth is using its Tariff Stabilisation Fund of +/- R60 million to fund their electrification programme and they are also making use of DBSA loans.

Most Local Governments domestic tariffs are subsidised by the commercial and industrial consumers. Port Elizabeth expects national tariff adjustments to cause their domestic tariffs to increase and their industrial tariffs to decrease. Mooiriver's Electrical Engineer (Mr Kromhaut) explained that the large textile industry in Mooiriver subsidised the domestic consumers in their area of supply.

### Eskom

Zanu Gwala (Electrification Planner, Kwazulu Natal) suggested that Eskom's surplus be allocated nationally to balance the urban and rural areas. Isaac Sokopo (Electrification Advisor, East London) feels that a tax on electricity sales could work. He also suggested having different connection fees according to the capacity needed.

### Provincial Government

André Evetts (Kwazulu Natal, Department of Local Government and Housing) expressed his concern about Local Governments dependence on the surplus of electricity sales. He suggested that money made from electricity sales should go to the same area for electrification. Johan van Rooyen (Eastern Cape Provincial Government, Department of Local Government and Housing) says an option for this would be to tax electricity sales.

On the issue of the National Electrification Fund, Jabu Ngwenya (Kwazulu Natal, Department of Local Government and Housing) said that the fund should be with the National Government. Sean Donnelley (Regional Planner for Kwazulu Natal) and Baby Ndlovu (RDP, Kwazulu Natal) said it would be “useless to have a fund for electricity and not for other services”, but they added that they would certainly take advantage of it. They went on to say that the fund could work if it was part of a common planning framework. Johan van Rooyen spoke of the limited money the RDP can allocate for electrification and therefore he would support such a fund. According to Mr Luxomo (RDP Director, E. Cape) the Eastern Cape Government has no policy on this issue (electrification planning) as of yet.

Both Johan van Rooyen and Mr Luxomo say that non-payment is the biggest obstacle for electrification to progress. Mr Luxomo is of the opinion that the situation should improve now that there are legitimate Local Government structures in place.

## 2. ELECTRIFICATION PLANNING AND CONTROL

### Local Government

Local Government officials and politicians were asked for their views on the national target for the electrification of 2.5 million by the turn of the century. Most of the people interviewed said that they had their own targets or that they did not know how they fitted in to the national picture. John Nash stated that there must be national planning for electrification. Rory Rioden said “We ought to be in the business of supplying whoever wants it” Chris Kapp said the following about the target:

- it needs to be scaled down;
- it needs more research;
- shouldn't it be calculated from the bottom up?
- what is the priority?

Ultimately, he would like to see the target scrapped all together.

Not one of the Local Government stakeholders interviewed felt that there is a role for the Provincial Governments in delivering electricity. Eddie Morton said “Provincial Governments are not, and should not be the deliverers, it should deliver policy, not services”. Both Chris Kapp and Charles Adams felt that some decisions had to be made at a national level and then implemented locally. They feel that the Eastern Cape Government is too administratively weak to play a role in electricity supply. Rory Rioden stated that Provincial Government must be stabilised.

### Municipal Electricity Undertakings

Howard Whitehead stated that “The RDP targets were never cascaded down to Local Government level”. Mooiriver has embarked on their own electrification project, even though the Natal Joint Service Board supplies in Bruntville. Charles Adams said that “The target of 2.5 million needs to be defined”. Port Elizabeth has always had it's own target. He went on to say that: “A target is only necessary if it drives the process”. He feels that Eskom is target driven whereas Local Government is demand driven.

On the issue of the role of Provincial Governments, Howard Whitehead said that perhaps the Provincial Government could play a reactive role. On the other hand, Charles Adams does not think that Provinces should have a role at all.

### Eskom

The 1996 Eskom target for Kwazulu Natal has been cut from 82 000 connection to 50 000 connections. Pat Brown (Eskom, Pietermaritzburg) believes that this cut was not transparent and that Eskom was influenced by the National Government. He says that

Eskom has been aware of the high costs of electrification in Kwazulu Natal for a long time and therefore should have made a plan. Zanu Gwala said that the reason for the high cost is that Eskom does not have access to a lot of the urban areas in the province and therefore has to concentrate on the sparsely populated areas.

According to Zanu Gwala, Eskom is hesitant to install RAPS (Rural Area Power Supply) because the area offices expect trouble for themselves by doing so. They have, however budgeted for this and will be installing 21 RAPS in rural schools across the province.

Eskom was involved in an initiative with Telkom, the Umgeni Water Board, the Department of Transport, and the Department of Planning to integrate the provision of services. Pat Brown felt that this is a difficult process because the development of services is driven from different levels.

Isaac Sokopo said that if electrification wasn't driven by targets, it would be happening differently i.e.:

- it would have been slower and there would have been a lower number of connections;
- Eskom would have been more responsible.

Zanu Gwala believes that the Provincial Government could play a role in the co-ordination of service provision. His personal opinion is that the Province could apply for one licence and then decide who supplies where. On the other hand, Pat Brown believes that the Province should not be involved until the political problems in Kwazulu Natal have been sorted out. In the Eastern Cape the relationship between Eskom and the Provincial Government was described by Isaac Sokopo as being "good, but dangerously good". He explains by saying that the Provincial Government relies on Eskom to a very large extent. He does however, feel that the Province could play a role because of the differing priorities of the "Western Eastern Cape" and the Eastern Eastern Cape".

Isaac Sokopo also said that the provision of water is the priority in the Eastern Cape, therefore Local Governments should prioritise their development projects, this could be done by stakeholders.

### Provincial Government

The Kwazulu Natal representatives were concerned to hear that Eskom had dropped its electrification numbers for the Province. Rohan Persad (Advisor to Minister of Economic Affairs and Tourism, Kwazulu Natal) felt that "Eskom is playing God". Sean Donnelley and Baby Ndlovu felt that the province should have a role in determining the prioritisation of projects on the basis of their economic development strategies. Mr Luxomo (RDP co-ordinator, Eastern Cape) felt that targets are necessary, but he warned they should not become "just a wish-list". Jabu Ngwenya

(previously from the Electrical Division of the Kwazulu Department of Works) said that the Province should not be involved with how Eskom spends its money.

Rohan Persad says that electrification should be planned around broader economic issues. He says it will be better to allocate resources sensibly and not to concentrate only on the existing back logs.

Sean Donnelley believes that there needs to be "combined infrastructure planning at the Provincial level". Rohan Persad also believes that electrification should be integrated with other services. In the Eastern Cape, according to Mr Luxomo, the priorities are 1) Water; 2) Roads; 3) Electricity. There is therefore a need for integration of service provision.

The question of the Role of Provinces in electricity supply and electrification was obviously answered differently to the other stakeholders mentioned so far. According to Jabu Ngwenya and André Evetts, the Provincial Government can assist Local Governments financially. Rohan Persad said that the IFP would like to play a role at the Provincial level. He feels that the Provincial Government is too weak, "They don't have a clear paradigm around integrated development.". Mr Luxomo spoke of district offices of the Eastern Cape Government which could play a role at a more local level. Johan van Rooyen said that Province could assist Local Government technically and with staff.

Jabu Ngwenya and André Evetts said that they were not going to install RAPS because "you can't experiment with public money".

### 3. INSTITUTIONS

#### Local Government

All the stakeholders interviewed stated that the issue of electricity sales surplus and the money generated for the Local Governments was their major concern. Eddie Morton suggested that Local Government be attached to the RED Boards by their assets and balance sheet. As has already been noted he would insist that Durban have controlling shares in a RED. The smaller Local Governments, in particular Mooiriver, say that their council depends on electricity sales to stay in existence. There is a concern that some small Local Governments have a capacity problem, this would have to be sorted out. They all, however, do agree that rationalisation of the Electricity Supply Industry is necessary. Both Eddie Morton and Chris Capp raised the concern that Local Government would lose significant economies of scale if it were to lose electricity supply.

On the issue of service quality, Eddie Morton said "It is better to keep the deliverer and the consumer as close as possible". Mr MacAllister (Town Clerk, Mooiriver) also expressed his concern about the level of service going down if electricity supply was taken away from Mooiriver. Despite the fact that Bruntville is more than half of Mooiriver, it is very poorly serviced. Chris Kapp suggested that a list of service/performance criteria be drawn up to enable the NER to determine on an objective basis which suppliers should be given a licence. He believes that this is imperative.

The stakeholders were asked for their views on Regional Electricity Distributors (REDs). Eddie Morton felt that Local Government should be represented on the RED's governing body and have a controlling share. The Boards should be made up of experts and not politicians. He suggested that RED's be modelled along the lines of the Water Boards. Rory Rioden would support an Eastern Cape RED if the problems of Local Government finance and electrification could be sorted out. Chris Kapp said he would favour a RED, but said that new structures shouldn't be created, but rather work with structures which are already in place. He feels that Local Governments would form their own RED's, although he admits that Port Elizabeth would not join with e.g. Uitenhage. Rory Rioden also supports keeping structures that are working. Mr MacAllister said he would fight the establishment of a RED.

#### Municipal Electricity Undertakings

As with the Local Government stakeholders, these interviewees also emphasised the importance of Local Government finance. Howard Whitehead says that Local Government will have to be guaranteed an income and that they must be represented on any new structure that could be formed due to rationalisation.

Although not questioned about the role of the NER, Mr Kromhaut (Mooiriver Electrical Engineer) did express his lack of confidence in the NER. Charles Adams

said that the NER will have a role if REDs are created, but if a National Distributor is established then the NER will not have a major role to play.

The issues of commercialisation and competition were discussed with Howard Whitehead and Charles Adams. Howard Whitehead said that the right climate and leadership would be necessary first. He feels that REDs or provinces could prepare the ground for commercialisation. Charles Adams feels that competition can come at the Generation level.

Howard Whitehead would favour a RED if it was run according to the Water Boards model and that Local Government be represented on the governance board. Mr Kromhau (Mooiriver Electrical Engineer) expressed concern about a drop in service levels if a RED were to be established. Charles Adams didn't feel that Local Government should necessarily be represented in RED. He posed the question "Who would represent Local Government?". He does however feel that the REDs should be co-ordinated at the Official's level.

### Eskom

Zanu Gwala expressed his concerns about Local Governments commitment to electrification because of their other priorities. He also feels that there is a problem with Local Government officials making statements that are not necessarily the perspective of the Local Government Council.

He further said that the Electricity Council should "stay out of politics, but remain legitimate with communities". According to Pat Brown, Local Government are "happy to let Eskom carry on with the job". Isaac Sokopo suggested that a Joint Electrification Committee be established.

### Provincial Government

Sean Donnelley and Baby Ndlovu believe that Local Government is more democratic and accountable than Eskom and therefore, should play a role in electricity supply. According to André Evetts and Jabu Ngwenya the Minister of Housing and Local Government in Kwazulu Natal says that electricity supply must remain at grass-roots level, in other words - with Local Government. In the Eastern Cape, Johan van Rooyen said that there is "pressure from Local Government to keep electricity as it is".

Jabu Ngwenya and André Evetts supported the idea of a RED in Kwazulu Natal. also said they do not have much faith in the Electricity Working Group or the NER. They believe that the licence to distribute electricity should come from the Provincial Government and not from the NER.

## 4. KEY FINDINGS AND CONCLUSIONS

### Financial

The main finding on this issue is that Local Governments will need some sort of secure financial compensation if their supply rights are taken away. Suggestions of legislation to ensure this happening were popular.

The idea of an Electrification Fund was also well received. Most of the stakeholders interviewed agreed that Eskom should share its surplus with other distributors. The Electrification Fund needs to be managed fairly so that the money gets allocated fairly. Every one agreed that cross-subsidisation should be managed at a national level.

Non-payment seems to be the biggest obstacle for sustainable electrification to take place. It was not clear whether stricter punitive measures should be put in place or whether the new legitimate Local Government structures will ease the situation.

### Electrification Control and Planning

The majority of the stakeholders, with the exception of the Provincial Governments themselves, agreed that there will be no future role for the Provincial Government.

It is clear that electrification in rural areas is suffering. Not many distributors are prepared to install RAPS as mentioned in the previous section of this document. There are however other priorities in these areas such as improved water provision and access roads. Integration of service provision is necessary and possible as shown by the integration project in Kwazulu Natal.

There was a concern from all the stakeholders that the target of 2.5 million connections needs to be defined, researched and partly based on a process of bottom-up planning from Local Government level. Most of the stakeholders suggested that some important decisions, such as the allocation of resources, should be made at a national level.

### Institutions

There are many viable, unelectrified urban and peri-urban areas that are not being electrified because the Local Authorities who supply them do not have the financial means, capacity or political will to do so.

As has been stated earlier, Local Government is very dependent on its electricity sales surplus. However, with the exception of Mooiriver, all stakeholders interviewed felt that rationalisation of the industry is necessary. The necessity for Local Government to keep a controlling interest in a restructured ESI was also emphasised.



The role of the NER is perceived to be a threat to the smaller Local Governments. The Kwazulu Natal Government mistrusts the NER completely. This issue will only be defined once the ESI has been restructured and rationalised.

There was no prevailing opinion about the commercialisation of the industry.

The general finding from the interviews in Kwazulu Natal is that the tense political situation in the province is hampering planning and development. In the Eastern Cape it was found that the Provincial Government is perceived to be weak and badly administered, this too is causing problems with development.

# **Planning considerations for rural electrification**

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Cecile Thom

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September 1995  
EDRC

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## 1. Introduction

In this paper considerations of importance for electrification planning pertaining to rural areas will be discussed. Firstly, background information will be provided on matters such as (1) the extent of electrification in 'rural' areas, (2) the use of electricity by rural households, (3) rural development, and (4) the role of electricity in rural development. Some of the key planning issues will be discussed in the section that follows.

### 1.1 Rural areas

It is difficult to define 'rural' areas in the South African context. One definition is that all areas which do not fall within promulgated local authority boundaries, are rural. However, this definition includes many large and fairly dense peri-urban settlements, particularly in the former homeland areas, which can be regarded as 'functionally urban'.

Because of a lack of accurate demographic and planning information on 'rural' areas, it is currently only possible to make a broad distinction between two categories of households: residents in the former homelands, and farmers, farmworkers and their families who live on commercial farms. An estimated 12% of households in all 'rural areas' (including farmworker households) are currently supplied with grid electricity, although the percentage of households outside of functionally urban areas with electricity is probably less than 12% (Thom et al 1995b). It has also been estimated that about a quarter of farmworker homes, and a smaller proportion of farmworker households, have been electrified to date.

### 1.2 Electricity use in rural areas

Household electricity consumption in rural areas is fairly low. For example, the consumption amongst newly connected households on prepayment systems in Eskom's former Pretoria distributor, which is regarded as the most rural in nature of all the former distributors, is about 55 kWh/month at present (measured in terms of electricity sales). Consumption is expected to grow with time after connection, but not much information is available on this at present.

Studies have shown that the majority of electrified households in rural areas use electricity for lighting (one study found this to be between about 75% and 90% for households earning less and more than R800 per month respectively), while a high percentage of electrified households also own TV's (about 30% and 70% for the different income groups) (Ward 1995). However, it has also been found that a significant percentage of electrified rural households, including households earning less than R800 per month, own appliances such as stoves, fridges and kettles, and use electricity for purposes such as cooking and water heating. One study put the percentage of electrified rural households earning less than R800 per month which use electricity for such purposes at about 25% (Ward 1995).

Nevertheless, it is clear that electricity does not become the dominant fuel in the majority of rural households, as wood and paraffin are still the main fuels used for cooking and heating purposes, particularly by lower-income households. *In most electrified rural households electricity is merely one of the forms of energy used.* For example, one study found

that about 77% of electrified rural households used more than one fuel, most of which used three or more fuels (Ward 1995).

### 1.3 Rural development

A centrally stated goal of rural electrification is to facilitate rural development.

Chambers (1983) defines rural development in the following way:

Rural development is a strategy to enable a specific group of people, poor rural women and men, to gain for themselves and their children more of what they want and need. It involves helping the poorest among those who seek a livelihood in the rural areas to demand and control more of the benefits of development.

This definition places people at the centre of development. It emphasizes the achievement of concrete goals, as well as the way in which these are defined and achieved, i.e. the process. Chambers argues that the primary development objective should be *to enable the poor to identify their development priorities and to obtain what they have identified as their needs*, while other objectives such as greater productivity, equity and sustainability should follow. The important point that needs to be made in this regard is that equity goals often are not achieved in rural areas *unless special provision is made to involve poor and marginalised people, including rural women, directly in the planning and implementation of development initiatives*. It can be concluded that, to be consistent with rural development objectives, and in order to achieve the goal of greater equity, rural electrification planning would need to provide for an increased role for rural people, particularly the poor, in identifying and achieving their goals.

This approach to rural development does not exclude economic development, but reflects the experience around the world that rural development which focuses primarily on economic development often leads to greater impoverishment of poor rural people, with only a few people benefiting from such development.

It is further agreed that a holistic and integrated approach to rural development is required to address the current problems and to cultivate opportunities in rural areas, given the multi-dimensional nature of the problems that exist, and the inter-relatedness of different facets of development - for example, water supply and health, roads and access to markets, etc. It is therefore argued that the elements of development that complement one another must be linked to ensure that the greatest possible synergistic effect is achieved. This is of particular importance for rural electrification, as will be discussed below.

Finally, international experience has shown that the decentralisation of rural development planning is crucial to the success of development initiatives, because of the great complexity and diversity of rural needs which require sensitivity to locally-specific conditions and problems, as well as the need to facilitate local involvement in planning, as discussed above (Thom et al 1995a).

### 1.4 The role of electrification in rural development

International experience has shown that the development impact of electrification *on its own* is very limited, both in terms of alleviating the energy problems of households, in improving the quality of basic services (for example, education and health services), and in

stimulating economic activity (James 1995). Only when electrification forms part of a broader initiative to achieve these objectives, and is properly coordinated with other inputs, can it play a meaningful role in the development of rural areas.

As discussed above, rural households generally do not adopt electricity as their primary source of energy, but continue to rely mainly on wood and paraffin. Unless problems with access to these fuels are addressed in addition to providing electricity, their energy problems would not have been alleviated to a significant degree. Furthermore, if schools and clinics electrification does not form part of a broader initiative to upgrade services at these facilities, such as the supply of equipment and the training of staff, it could have virtually no impact on the quality of services at these facilities. The common assumption that electricity 'causes' economic development has also been shown to be a fallacy. Rather, the impact of electricity seems to depend on the *existing* level of development in an area. The higher this existing level of economic activity, the greater the impact of electricity. However, electricity would have very little impact if introduced in areas where little economic activity exists already (Foley 1990).

## 2. Key planning issues

In this section planning issues which are of particular importance with respect to electrification in rural areas, will be discussed.

### 2.1 A rural development framework for rural electrification

A national rural development framework for rural electrification is urgently required. Such a framework will set out the role of electrification in rural development, as well as the specific development objectives of rural electrification programmes, and with this identify priorities for rural electrification on the basis of development priorities,

At present, the focus of the national electrification programme is on the electrification of households, and, in rural areas, specifically households in the former homelands. In addition, schools and clinics have been identified as priorities for rural electrification. It is not clear *on what grounds* these have specifically been identified as priorities, rather than farmworker households, for example, or water supply in rural areas, or small-scale agriculture. Certainly the priorities have not been established by Eskom alone, as the national government has emphasised the electrification of schools and clinics in addition to household electrification. One could question the priority placed on schools electrification in particular, as electrification is probably one of the least critical inputs to improve the quality of education in South Africa. On the other hand, the virtual absence of small-scale agricultural and water pumping needs from the priorities of current electrification programmes probably needs to be reviewed urgently.

Furthermore, no specific objectives have been formulated for the national electrification programme, or the schools and clinics electrification programmes conducted by Eskom. These programmes are essentially electrification programmes and not development programmes. The aims have been defined in terms of numerical targets, and not in terms of particular development needs. For example, schools are being electrified without a clear understanding of the facilities which will realistically be provided to these schools in the

future. In the case of off-grid electrification this is of particular concern, as the system design load can have a significant impact on the costs of an installation.

## **2.2 Coordinated rural development and electrification planning**

As discussed above, rural electrification which is conducted in isolation from other development initiatives is bound to have very little development impact in rural areas. However, very little effective coordination between rural development and electrification planning is taking place at present. The national electrification programme is not located within an integrated development programme, but is mainly driven by the electricity distribution industry, and Eskom in particular. Although attempts are made to involve other parties concerned, such as the Departments of Health and Education in the electrification of schools and clinics, the electrification programme is much further advanced than programmes to improve services in some other sectors, with the result that very little coordinated planning is taking place. Small-scale agriculture in particular is at danger of being marginalised by the present electrification programme because of the underdeveloped state of planning for this sector. This situation is compounded by the fact that government structures to facilitate development coordination at provincial level are still in the process of being established. In this context the appropriateness of national electrification targets which have to be met irrespective of progress in other development sectors, needs to be questioned.

## **2.3 An integrated energy planning framework for rural electrification**

As discussed above, electricity generally does not meet most of the energy needs of rural households which have been electrified. Broad-based or integrated energy planning is required to ensure that the energy needs and problems in rural areas are addressed in a comprehensive and consistent manner (Thom et al 1995a). Some energy programmes have been initiated to address broader energy needs, such as the social forestry programme presently funded and managed as part of the IDT's Rural Energy Programme. However, these programmes generally have a limited scope, and energy service provision in rural areas is still characterised by a piecemeal approach.

A national policy framework to facilitate integrated energy planning in South Africa is thus required, which identifies the specific role of electricity in meeting energy needs in rural areas in relation to other fuels, amongst other things. The respective roles of grid and off-grid electricity in rural areas also need to be addressed - the planning of off-grid electrification is currently hampered by the lack of clear national criteria for identifying areas which are to be electrified by the grid.

A recent aspect of Eskom's rural electrification policy has been a commitment to 'integrated energy planning', whereby other supply and demand strategies are considered as alternatives or complements to electrification. This is gaining particular importance in the light of the proposals to provide load limited supplies in a significant percentage of the areas which will be electrified in the future. However, it is unlikely that such an approach could be driven successfully by an organisation aligned with a particular energy carrier, as is the case with Eskom.

## **2.4 An institutional framework for electrification planning**

Another significant problem is the lack of an institutional framework for electrification planning, with clear roles for different players in this field, including government structures at national, provincial and local levels. The role which local government in rural areas could play in electrification planning and development coordination generally, requires specific attention (see below).

At present electrification planning for rural areas is essentially conducted by the Independent Development Trust (IDT) and Eskom, both of which are public sector institutions with very specific objectives. The IDT was formed to address poverty and the needs of the poorest, for which it utilises grant funding from the state. Eskom, on the other hand, is a public utility which has been charged with the cost-effective supply of electricity to South African consumers, and finances itself through the capital and money markets.

Eskom in particular, being responsible for two-thirds of the national electrification programme, is planning what is in fact a government-sanctioned and highly subsidised national programme, and is effectively developing national electrification policy for rural areas, with very little direction from national government. However, Eskom is not an appropriate institution to take responsibility for rural electrification policy and planning. The utility itself has indicated that it expects of government to provide a framework for rural electrification planning. However, in the absence of the necessary institutional and regulatory arrangements which will enable government to set rural electrification policy and to oversee its implementation, some vital decisions are being made within Eskom, which could have far-reaching implications for rural electrification in the future.

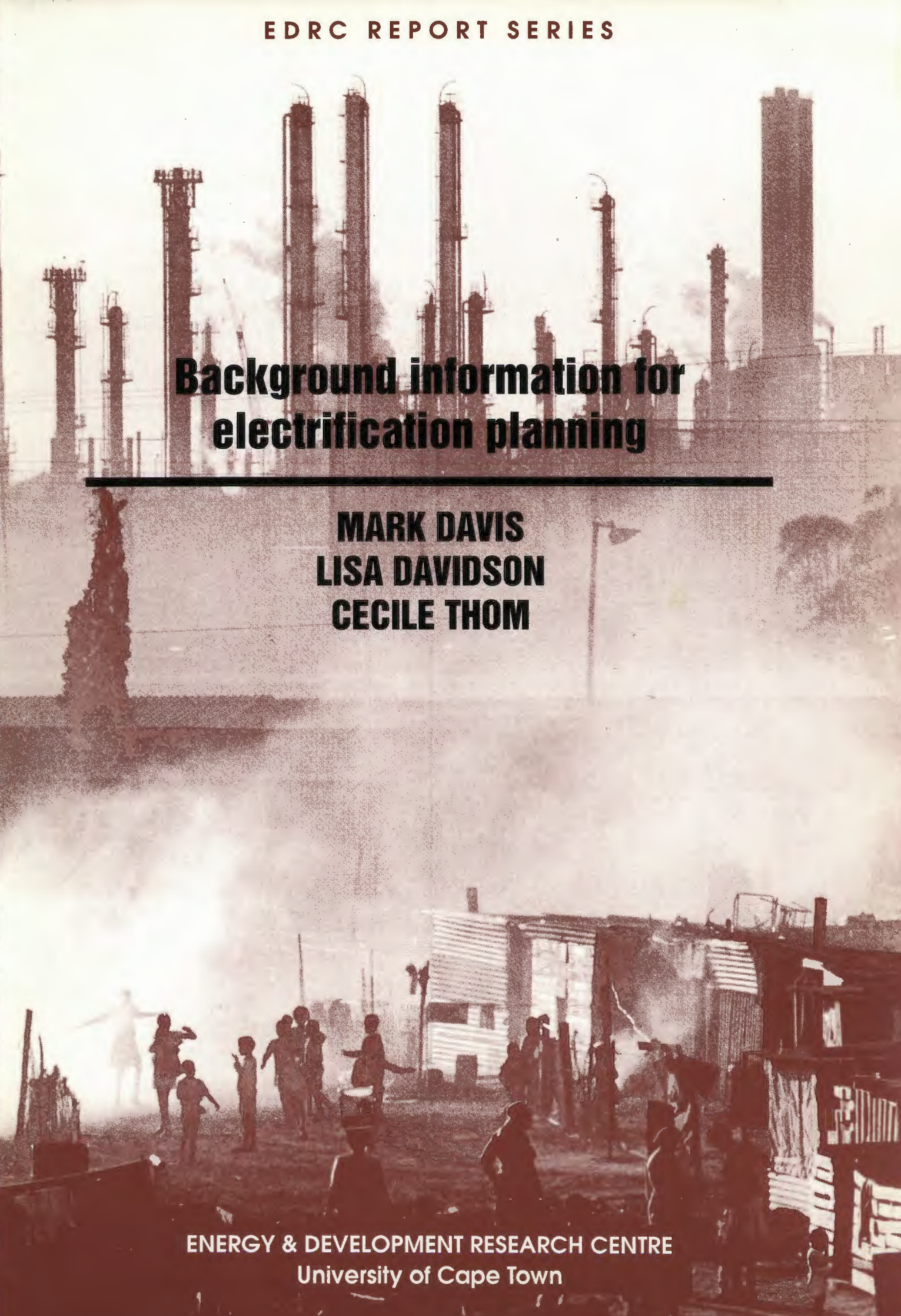
## **2.5 Decentralisation of planning concerning rural electrification**

A decentralised approach to development planning in rural areas has significant implications for rural electrification planning, although these have not yet been fully explored. Matters of particular importance include implications for the way in which the financing of rural electrification projects is structured, as well as the potential role of rural local government with respect to electrification planning (Thom et al 1995a). Control over financing is an important element of control over planning, and therefore requires considerable attention, particularly in light of the unequal relations of power that generally exist between rural communities and powerful outside agencies such as Eskom. Generally the objectives of a decentralised approach would be to provide for greater control by rural energy users over the allocation of resources for electrification, but at the same time, to prevent the concentration of these powers in a particular section of rural society, which excludes the poor, and women in particular (Thom et al 1995a).



### **3. References**

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# **Background information for electrification planning**

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