The Distribution of Power:

Recommendations on Electrification Policy

Mark Davis, Mark Pickering & Grové Steyn

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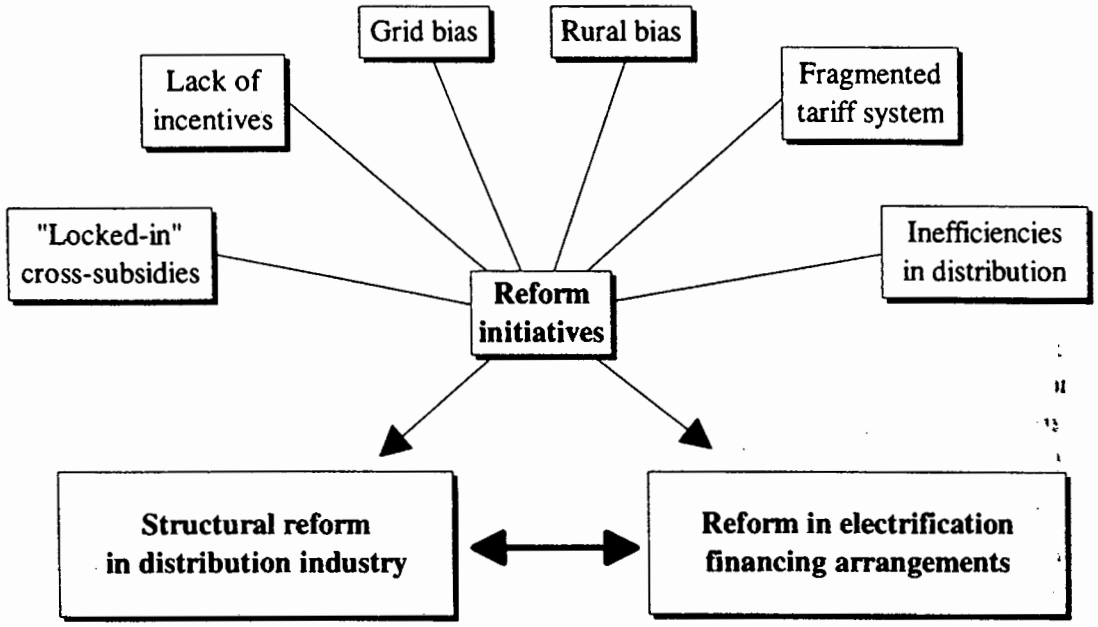
Executive summary

This document details a set of proposals for a new system of electrification planning and financing. Key issues facing electrification policy in South Africa are identified. Policy options are examined in a systematic manner, and recommendations made. The focus is on the design of an appropriate institutional and financing framework to support the national electrification programme, with some discussion on guidelines for resource allocation.

The policy issues

Electrification financing is currently dependent on cross-subsidies within individual distributors. Combined with the current structure of the industry this has lead to a number of distortions in the electrification programme. The resource allocation system, dominated by cross-subsidies within Eskom, is biased towards rural areas and against off-grid technologies. The supply rights system means that Eskom's resources benefit only those areas supplied by Eskom. The fragmented distribution industry results in a proliferation of tariffs which do not reflect costs systematically, and there is evidence of inefficiencies within the industry. Finally, incentives to continue the electrification programme rely on a tacit understanding between government and utilities which is highly vulnerable to both political and financial pressures.



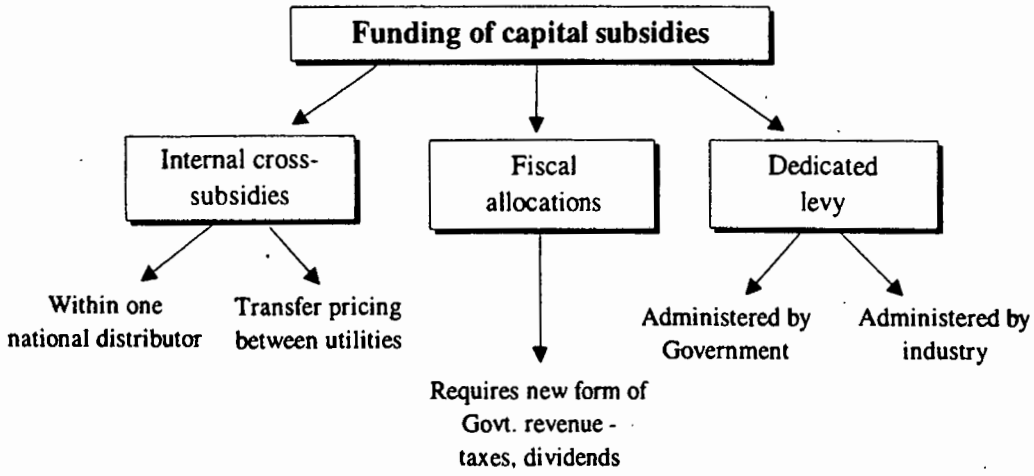
It is clear that many of these issues can only be resolved if the distribution industry structure is rationalised. Furthermore, it is clear that such a rationalisation, although necessary, will be insufficient in itself. Attention must also be paid to the design of new electrification financing mechanisms and associated institutional arrangements. A rationalised distribution industry makes new electrification options possible, but does not automatically solve the existing problems.

The options for electrification financing

Assuming that the distribution industry will be rationalised, it is necessary to consider what forms electrification financing could take. Three types of financing requirements exist: capital for investment in commercial projects, capital for investment in non-commercial projects (or the non-commercial element of projects), and funds to cover operating losses arising from (mainly rural) electrification projects. Clearly, commercial

projects can be financed from commercial sources, with possible interventions required from the DBSA or Eskom during the period of structural change. It is the subsidy element of electrification projects which poses special difficulties.

There are three possible financing mechanisms for subsidising the capital costs of electrification. Firstly, there is the option of internal cross-subsidies within the electricity supply industry - the system used at present. Secondly, a dedicated electrification levy may be introduced, to be administered by Government or the industry. Thirdly, fiscal allocations may be provided for electrification.



The system of internal cross-subsidisation is neither transparent nor equitable, as it concentrates subsidies within individual utilities. Although it is possible to refine the system through the use of transfer pricing at the bulk supply level, this method does not substantially improve transparency, accountability or remove the bias away from off-grid technologies.

A dedicated levy - effectively an electrification fund - may meet the criteria of transparency, accountability and technological neutrality, but may prove difficult to implement. In addition, there is likely to be resistance to a fund and levy which does not directly benefit those who contribute to it. Further, the establishment of a dedicated levy and fund would require new institutions capable of administering and allocating the resources.

A system of fiscal allocations to electrification is therefore recommended as the preferred option as it provides for transparency and accountability, and allows for funds to be allocated according to Government's electrification policies. Furthermore, this system ensures that the electrification programme will compete for funding along with other demands on the Government's budget and so should find its appropriate position in the ranking of national priorities.

Since this system will require additional Government expenditure it will have to be matched by addition revenue. Two primary options exist here: the application of company tax and dividend payments to the electricity industry (Eskom would provide the bulk of the requirements with a 35% companies' tax and 33% dividend); or a special tax on electricity (a levy). Taxation and dividends is the recommended option as it removes current market distortions in the energy markets (i.e. it "levels the playing fields" between different fuel sources, and facilitates the introduction of new participants in the power generation industry). In addition, the introduction of these changes may form part of a policy package for all public enterprises which may be implemented regardless of electrification considerations.

Options for funding operating losses on electrification projects are:

- to increase electrification tariffs;
- to increase capital subsidies to reflect the present value of future operating losses;
- to use industry-wide cross-subsidies and manage transfers between distributors; and
- to use cross-subsidies within a distributor's customer base (all customers or only domestic customers).

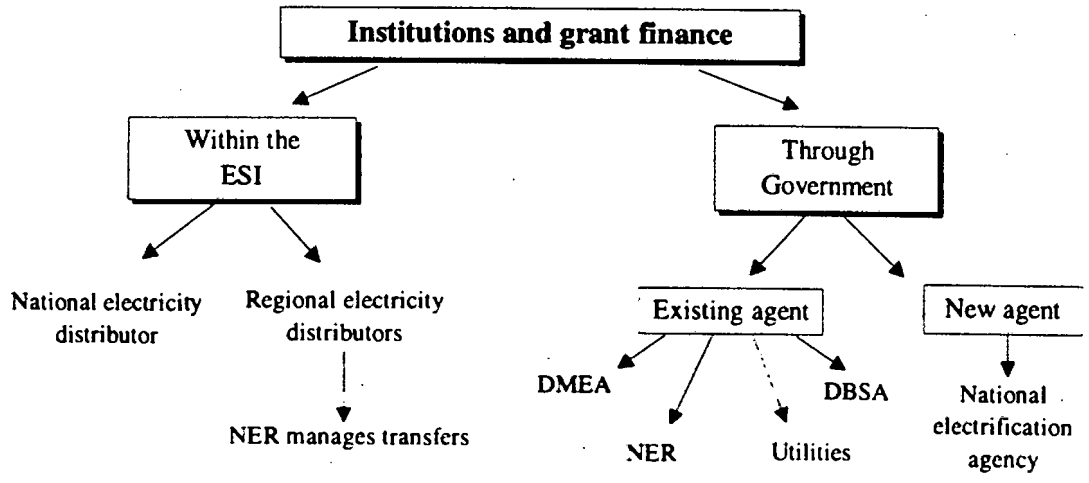
The first option conflicts with the objective of achieving standard domestic tariffs. The second option is impractical as it requires estimation of a very uncertain quantity. The third option requires detailed reporting of electrification costs (and the apportioning of overhead costs to electrification) and is potentially open to abuse. The last option, that of allowing distributors to set tariffs (preferably only domestic tariffs) to cover operating losses is the preferred option.

Institutional arrangements for allocating subsidies

Institutional arrangements for allocating grant subsidies to electrification are closely linked to the financing mechanism employed. Essentially there is a choice between off-budget or on-budget financing.

If off-budget financing is employed, i.e. electrification financing is kept within the electricity supply industry, then the institutional arrangements will depend on the structure of the distribution industry itself. In the case of a national distribution monopoly, it is likely that no new institutional arrangements will be necessary. If regional distributors are established, it will be necessary to use transfer pricing at the bulk level to effect financial transfers between distributors. This would require some form of regulation, and it is likely that the NER would be best placed to fulfil this function.

Alternatively, if the option of financing through the Government budget is implemented, then some institutional capacity will be required to allocate the funds. The choice is between using existing institutions (such as the DMEA, electricity utilities, the NER, the DBSA etc.), or creating a new agency (a "National Electrification Agency"). The preferred choice is for the DMEA to take prime responsibility for allocating the funds. However, capacity constraints within the DMEA may make this option impractical. Consequently, the DMEA may choose to create a suitable agency to undertake this task (an NEA), or to sub-contract much of the administration to another organisation, such as the DBSA. This arrangement could provide greater development benefits through cross sectoral integration within the Development Bank.



Summary of recommendations

This paper recommends that a set of institutional and financing arrangements be adopted to ensure that the electrification programme continues without adverse financial implications for utilities. In essence, the recommendations assume that the distribution industry will be rationalised and that new subsidy mechanisms and associated institutional arrangements will be created.

The main elements of the recommendations follow.

- Electrification capital costs should be subsidised through fiscal allocations.
- Operating losses on electrification projects should be met through cross-subsidies within the domestic consumer base of each utility.
- The disbursement of capital funds should be the responsibility of the DMEA, with contracted assistance from other institutions, such as the DBSA.
- This additional Government expenditure should be matched by additional revenue from the taxation of the electricity industry and, if this is inadequate, the imposition of a special levy on electricity sales.

Implementation of these recommendations will entail restructuring of financing and institutional arrangements, and clearly there is much detail to be filled in. Nonetheless the main objective of this investigation has been achieved in proposing an electrification policy framework and demonstrating that it is both desirable and workable. In short, we believe that the implementation of these recommendations will lead to an appropriate distribution of power.

1. Introduction

This paper forms part of the research project 'Electrification planning: A review with suggestions for alternative models'. The project was undertaken by the Minerals and Energy Policy Centre (MEPC) and the Energy and Development Research Centre (EDRC). The project was funded by the Department of Mineral and Energy Affairs (DMEA), the DBSA, Eskom and the National Electricity Regulator (NER).

The research has examined electrification planning in South Africa in a systematic and broad manner. A number of activities have been undertaken by the research team including the following:

- A literature review of electrification planning in other countries;
- A review of stakeholder attitudes towards electrification planning;
- Financial modelling of household electrification; and
- Scenario planning for the electricity supply industry, through a series of participatory workshops.

The purpose of this paper is to utilise the information and insights gathered during the research process to prepare a set of proposals for a new system of electrification planning in South Africa. These proposals are based on an analysis of the key constraints, opportunities and tasks facing the industry and Government, and take cognisance of the current status of debate regarding these issues.

The focus of this paper is on financing mechanisms and institutional arrangements for electrification, particularly grid extension by distribution utilities. Although it is recognised that off-grid systems, and in particular photovoltaic systems, are important technologies in the supply of electricity to rural communities, they are not accorded as much attention. This is a consequence of the limited experience with publicly supported photovoltaic dissemination projects and the variety of proposed, but largely untested, approaches to off-grid electrification. Despite this lack of experience, efforts have been made to design electrification policies which are flexible enough to incorporate off-grid systems once implementation strategies are agreed on.

The paper commences by summarising the current status of institutional and financing arrangements in the electricity supply industry (ESI), and then presents an analysis of the central problems inherent to these arrangements. This is followed by a discussion of the financing and institutional options available to support electrification. Financing issues define the requirements of electrification and must be understood prior to recommending mechanisms to meet these requirements. Arrangements to channel public support for electrification are then considered as part of institutional issues, as well as the allocation of subsidies, the monitoring of the electrification programme and, lastly, the evaluation and reformulation of electrification policies.

2. Background

This section outlines existing institutional arrangements in the South African ESI. This is followed by a discussion of the problems currently faced by the distribution industry and how these problems affect electrification planning.

2.1 Current institutional arrangements

Institutional arrangements in the ESI are currently under transition. Figure 1 illustrates the institutional structure prior to the initiation of structural changes in the industry.

The electricity industry is largely dominated by Eskom, which owns 92% of generation capacity (Eskom 1994), owns and operates the national transmission system, and distributes electricity to 1.2 million end-users - approximately one-third of all electricity consumers in the country (NER database). Not only does Eskom dominate the ESI, but it also plays a significant role in the national economy. As a portion of GDFI[1], Eskom's investments accounted for a peak of 15% in 1985. Although this has since declined to 7% in 1990, it still represents a significant portion of the total GDFI. Eskom's influence on the financial markets is also significant since operations are financed through a combination of retained earnings and debt. In 1995, Eskom's net debt totalled R27 billion, and the "Eskom 168" bond is a benchmark in the markets, trading at a rate close to that of Government stock. As an employer, Eskom has reduced its level of employment from a peak of 66 000 to 40 000 over the past ten years.

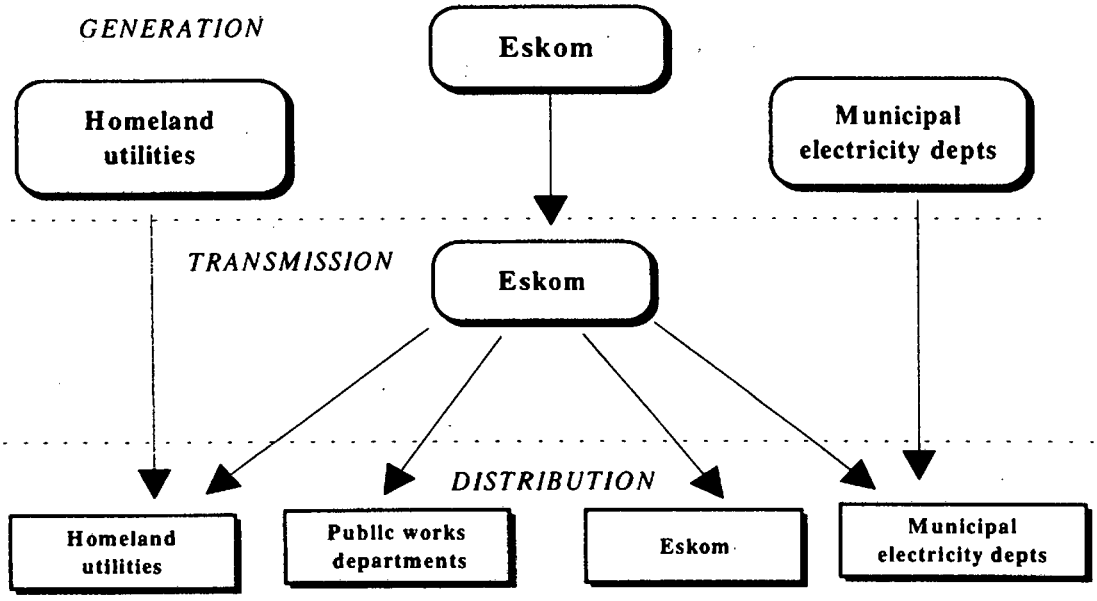


Figure 1: institutional arrangements prior to restructuring

Generation and transmission

Although Eskom does not enjoy a statutory monopoly over generation, it has a *de facto* monopoly. In 1995 it produced 96% of electricity in the country (Eskom 1995). Some municipal electricity departments still own and operate relatively small generation facilities (Bloemfontein, Cape Town, Johannesburg, Port Elizabeth and Pretoria). Of the former homeland utilities, only Teskor in the Transkei had any operational generation equipment (hydropower), which has now been transferred to Eskom.

Electricity transmission through the national grid is the responsibility of Eskom and all distributors purchase most, if not all, of their power requirements from Eskom. At present self-generators (a few municipalities and some private enterprises) consume all their production within their own distribution networks or on site without wheeling it through Eskom's grid.

Within the generation and transmission sectors, it is widely expected that, at least in the medium term, Eskom will continue to act as a *de facto* monopoly business. Eskom has been given the task of absorbing former homeland utilities within its structure.

[1] Gross Domestic Fixed Investment

Distribution

The distribution industry has always been, and continues to be, highly fragmented. Local authorities have traditionally had the right to supply electricity within their area of jurisdiction, and the new constitution defines electricity distribution as a local government competency (South Africa 1996). However, distribution rights are contingent on obtaining a licence from the National Electricity Regulator (NER), which has the power (with good cause) to allocate local authorities' distribution rights to other entities.

In 1995, one of the first tasks of the newly formed NER was to issue licences for all generation, transmission and distribution undertakings. Although generation and transmission licences were issued without significant changes or disputes, the issuing of distribution licences was more complex. Prior to the licensing round, electricity distribution throughout the country was divided between approximately 400 bodies. In urban areas, the complexity of former race-based local authorities was reflected in electricity distribution arrangements. In rural areas, distribution rights were divided between Eskom, former homeland utilities, government departments, provincial authorities and joint service boards. Given this complex and unsatisfactory arrangement, the NER was reduced to issuing temporary licences pending a policy decision by Government on how to tackle rationalising the distribution industry. Consequently, in September 1995, 398 electricity distributors were licensed for nine months (these licences have now been renewed for a further eighteen months) and the composition of this group is shown in Table 1. The licensing round did serve to effect some rationalisation, with single licences being issued for the metropoles and local government areas, unless Eskom applied (usually in the case of townships served by Eskom) in which case Eskom was licensed (Morgan 1996)[2].

Table 1: Electricity distributors in South Africa
(Source: Trollip 1996)

Number	Institutions
1	Eskom
362	Local authorities
7	Joint service boards, regional councils
7	Provinces
5	Former homeland & self-governing territory utilities
3	National government distribution
13	Privately owned (mostly self supply)
398	**TOTAL**

2.2 Problems in the distribution industry

It is in the distribution industry that major institutional reform is expected, and it is worth tracing the history of the debates relating to this topic. The 1922 Electricity Act which established what is now known as Eskom also put in place a rudimentary regulatory structure. The Electricity Control Board was given the responsibility of licensing electricity undertakings and approving tariffs of licensed undertakings.

[2] In metropolitan areas, a single licence was issued and the metropolitan authority was then able to allocate supply responsibilities to the various substructures. The only exception to this case was the Cape Metropole where boundaries had not been defined at the time of licensing.

However, municipal electricity departments were excluded from the requirement to obtain a licence and so were effectively excluded from the regulatory ambit of the Board. Municipalities were also awarded the first right to supply within their own area of jurisdiction.

The roots of the current fragmentation of the distribution industry and the historical unequal distribution of access to electricity can be found in this regulatory system, together with the apartheid system of separate development.

The first effect has clearly been the entrenchment of electricity distribution as a function of local government. From early days, most municipalities have exercised their powers to reticulate electricity and this power (or right) has been confirmed in the new constitution[3].

Secondly, and equally clearly, the system has been responsible for the inequitable access to electricity. Apartheid, as applied to urban areas[4] meant that local authorities had electricity departments which generally served only their racially-based areas of jurisdiction. Former white local authorities were relieved of the responsibility of providing electricity to neighbouring black residential areas. Government systems established to serve these neighbouring townships failed to invest adequately in service provision, either due to a lack of political will, or as a consequence of inadequate technical and financial resources. In rural areas, the establishment of homelands and self-governing territories was accompanied by the rights of electricity supply being allocated either to the governing authorities of these areas, or to new utilities. As in urban areas, electrification has been hampered by either a lack of political will or inadequate financial resources. In contrast, commercial farms in non-homeland rural areas were relatively effectively served by Eskom through the use of extensive cross-subsidies from the general customer base. Arrangements in both urban and rural areas thus acted to lock resources out of areas where electrification was required. Black urban areas as well as homelands were not served by institutions which could utilise the revenue base of major industrial, commercial and affluent domestic consumers to extend electricity supply.

Thirdly, the regulatory system left tariffs of municipal distributors under the control of local councils. Although this may be justified in terms of accountability through elected bodies, it made it possible for municipalities to use electricity distribution as a cash-cow in order to supplement rates revenue. Although it may be argued that this is, in effect, not substantially different from other forms of local government taxation, it has meant that local authorities are now dependent on extracting substantial resources from electricity distribution.

These consequences of the governance environment have had direct implications for the implementation of a national electrification programme. Firstly, there has been a bias towards rural projects and away from off-grid supply technologies. Secondly, access to financing and cross-subsidies is unevenly distributed across the country. Lastly, the fragmented nature of the industry has meant that there is a proliferation of tariffs and possible poor operating efficiencies in local government electricity departments. Each of these is described in more detail below.

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3 Electricity distribution is listed as a local government competency in the new Constitution (in its present form still a bill) (South Africa 1996).

4 As implemented through the Black Urban Areas Consolidation Act No. 25 of 1945 and the Group Areas Act of 1950.

The rural bias

The fragmentation of supply rights has meant that Eskom, which has had the most resources to target at electrification, has largely been excluded from urban areas. Consequently, the electrification programme over the past few years has had a strong rural focus. Although it may be argued that electrification will have to reach into rural areas at some stage, the current level of resource allocation to rural areas is largely a product of the supply rights system, rather than a consequence of an explicit policy decision. The alternative scenario, where electrification projects are prioritised on the basis of least cost (or maximum net present value), would inevitably mean a greater focus on urban sites earlier in the programme, and would represent a more rational allocation of resources.

As a consequence of this bias, the electrification programme is being forced to deal with the peculiar stresses which rural electrification imposes. High connection costs, extremely low consumption rates, and reduced scope for wider economic benefits are all features of rural electrification. International experience has tended towards a more circumspect view of rural electrification. The extensive benefits that were once anticipated have, in general, failed to materialise and strategies have focused on the need to carefully select projects, co-ordinate electrification with other development projects and promote a demand-driven rather than supply-driven grid expansion programme in rural areas.

Off-grid electricity systems

Not only does the present system mean that Eskom' resources are not available to all areas of the country, but that Eskom's electrification funds are earmarked exclusively for grid extension, without adequate consideration of off-grid systems. Although solar home systems may represent a lower-cost alternative to grid extension in many rural areas, Eskom's tendency to define its technical competencies as electricity provision through the grid has meant that these systems have not been utilised. However, the recent establishment of a Non-Grid Electricity section within Eskom may mark a change in approach. Despite this, off-grid electrification thus far has been concerned exclusively with rural school and clinic electrification and has used grant finance rather than Eskom's own investment resources to do this. Further, the Non-Grid Electricity section is not institutionally linked to Eskom's Distribution Division, further decreasing the opportunities for integrating off-grid systems into the electrification programme.

It is ironic that the very institutional arrangements which have promoted the rural bias in the electrification programme have militated against the use of off-grid technologies. Solar home systems are advantaged, in cost terms, where communities are small, remote and settlement patterns dispersed. Consequently, an electrification programme with a rural focus would benefit from the inclusion of off-grid technologies.

Access to financing and cross-subsidies

The present institutional system has lead to inequitable access to financing resources for electrification. Eskom, as an extremely large utility with a *de facto* monopoly and a healthy balance sheet, is able to raise capital for electrification projects easily, either from retained earnings or at good rates on the capital markets. Municipal electricity departments are in a much weaker position to raise capital, partly because of their position as municipal authorities, and partly because of their limited revenue base. The situation is exacerbated for the smaller towns where the investment requirements, as a proportion of their asset and revenue base, are that much higher.

Related to this is the differing ability of Eskom and municipal authorities to lever cross-subsidies from other consumers to cover losses on electrification projects. For Eskom, an operating shortfall of say R20 per electrification customer per month is fairly easily covered by surpluses made on other electricity sales. The cross-subsidy is available and unlikely to significantly affect Eskom's financial position or ability to raise debt. For municipalities, cross-subsidies are that much harder to lever and sustain. In fact, municipal electricity distributors are keenly aware of the fact that they are required to cover the costs of their own electrification projects, as well as contributing towards Eskom's surplus which is then used to cross-subsidise Eskom's electrification projects (Davidson 1995).

The financing constraint faced by municipal distributors is further compounded by the dependence of other services on existing surpluses in the electricity industry. Municipal distributors generate a surplus of around R1.7 billion per annum (Mountain 1995). If this surplus continues to be eroded by losses on electrification projects, local authorities will undoubtedly face a financial crisis. The impact of this would be particularly severe at a time when local authorities are expected to be actively involved in extending and improving a range of services to all residential areas within the new local government boundaries.

Tariffs

The fragmentation of the distribution industry is matched by a proliferation of tariffs. Tariff levels vary by over 200% in all consumer categories as shown in Table 2. Although part of these price variations can be explained in terms of cost differences, it is almost certain that the main cause of variation is due to differing surplus revenue requirements of municipalities. This tariff system is undesirable from both an economic perspective, since it distorts electricity markets, and from an equity perspective, particularly in the domestic sector.

Table 2: Tariff range by consumer category [c/kWh - 1994]
(Source: EWG 1996a)

Category	Minimum	Maximum	Mean	Range/Mean
Domestic	9	48	17	230%
Mining	6	33	12	230%
Industrial	4	52	13	360%
Commercial	8	48	17	240%

Efficiency

It has been speculated that the fragmentation of the electricity distribution industry is a cause of inefficiency in the industry. Although it is not necessarily true that local distribution agencies are inherently less efficient than larger agencies, there is some evidence to indicate that many municipal distributors are too small to reap possible economies of scale. Distribution costs among municipal agencies vary by nearly 50%, with a clear trend towards lower costs for larger distributors. Although most of this variation is due to the differences in the cost of purchased energy, the variation in other distribution costs, although small in absolute terms, is equally broad in percentage terms, as shown in Figure 2. Although these results do not mean that rationalisation will inevitably lead to efficiency gains (as the causes of the variations in costs are not clear), they do indicate that there are *possible* gains.

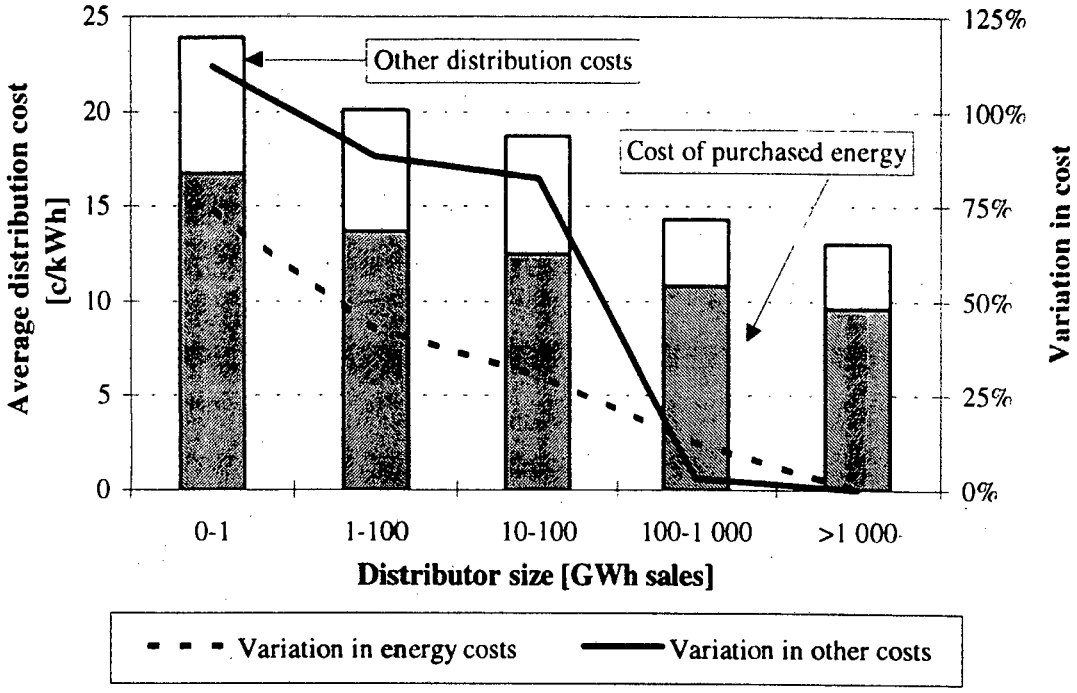

Figure 2: Average distribution cost by distribution size
(Source: EWG 1996a)

3. The objectives of electrification policy

Reform in the institutional, financial and governance framework for electrification should meet five requirements. It should (1) provide incentives for utilities to embark on electrification; (2) ensure the transition does not disrupt current electrification programmes, makes use of existing strengths, and recognises resource and capacity constraints; (3) provide clarity on the roles of different institutions; (4) ensure transparency of funding arrangements and a pricing policy which supports cost-reflective tariffs; and (5) ensure that the programme is monitored and the evaluations fed back into an effective policy formulation process. Each of these issues is dealt with in more detail below.

3.1 Electrification incentives

Utilities require incentives to embark on electrification and to develop innovative approaches to electrification. There is a clear conflict of interest between efforts to commercialise public utilities, and the pressure to implement unsubsidised electrification projects. It is important that electrification planning proposals address this conflict directly, and provide incentives for utilities to embark on electrification without compromising commercial practices or threatening financial viability.

The provision of subsidies is the obvious solution to this dilemma. The question is whether such subsidies are provided through the fiscus, or as cross-subsidies within the industry. To be effective subsidies need to be associated with targets. In effect targets and subsidies are two sides of the same coin - a target requires a subsidy to be achievable, and subsidies can only be provided on the basis of targets.

The provision of subsidies needs to be carefully balanced against the need to encourage utilities to innovate and adopt cost-minimising strategies. Subsidies which remove risk altogether are undesirable, as they are likely to be abused. Consequently, subsidies should be designed to share risk and to encourage implementation strategies which utilise subsidy resources carefully.

One of the advantages of adopting targets in an electrification programme is that they introduce a requirement that medium-term planning be undertaken, in order to provide targets with some substance. This, in turn, provides some certainty around the future of electrification. In addition, targets assist in motivating utilities and provide benchmarks against which performance can be evaluated.

One the other hand, targets may focus attention on meeting simplistic evaluation criteria (i.e. number of connections), without adequately considering the impacts of the programme. Consequently, it is important that monitoring and evaluation adopt a more sophisticated approach than merely counting numbers of connections, and attempts should be made to examine the other, and often less tangible, impacts of electrification.

Targets, and the nature of planning associated with them, necessarily entail a delivery programme that is supply driven. To a certain extent, this is inevitable in a network where individual projects are inter-related and the costs of future projects are partly dependent on the implementation of other projects. To overcome this problem targets should be combined with a planning procedure which includes demand-driven elements, allowing a "bottom-up" planning procedure to be matched to "top-down" targets and financing arrangements.

Lastly, it is important that targets are not inflexible and that they recognise the associated financing and capacity limitations. Targets should be designed with opportunities to renegotiate them in the face of changes to economic and fiscal expectations as well as technology changes.

3.2 Transition

It is important that new electrification planning and financing arrangements should be designed and implemented in such a way as to ensure that the transition is smooth.

Firstly, this means that electrification should not be interrupted. Inevitably, if the distribution industry is rationalised, there is potential for electrification programmes to be disrupted. The introduction of industry rationalisation, together with a carefully considered electrification planning and financing strategy, should help to ensure that electrification continues during the transition phase.

Secondly, new proposals and the introduction of these proposals should take cognisance of the capacity constraints facing the industry. Partly this means that existing institutional strengths should be utilised, and proposals should therefore be wary of creating new institutions which require building from scratch.

3.3 Clarity of institutional roles

It is important that the separate functions related to electrification be clearly identified, and institutional roles clarified. The discrete activities within electrification include policy formulation, planning, financing, implementation, monitoring and evaluation.

It is widely recognised that utilities are more effective if operational and investment decisions are left in the hands of utility managers. However, there are three important exceptions to this. The first occurs where utilities do not face competition and managers are able to abuse a monopoly position to pursue goals other than cost-efficiency. Under these circumstances economic regulation is required to bring pressures to reduce costs. The second exception occurs where environmental costs, particularly relating to electricity generation, are not included in the financial costs of the utility. In this case environmental regulation is required. The third exception occurs when the electricity industry is required to pursue the social policies of Government. Here explicit

mechanisms should be introduced to effect these policies without compromising the utilities' commercial objectives.

The rationale for state intervention in the electrification programme is based on three factors. Firstly, electrification is an example of Government requiring utilities to act against their own immediate financial interests, thus requiring that policy guidelines be provided for utility managers in order to reconcile conflicting pressures. Secondly, the scale of subsidy resources is large - of the order of R1.6 billion per annum. Although it is expected that these resources must be raised from within the ESI, they are still, in effect, public resources and Government has an interest in ensuring that these funds are allocated appropriately. Thirdly, monopoly distributors may seek to pass the costs of electrification directly onto customers, without adequately pursuing more cost effective implementation strategies.

Regardless of the existence of such a clear rationale for Government intervention, it is still important to guard against excessive Government interference. Whilst Government must play a strong role in designing overall electrification policies, it should leave the implementation of these policies, as far as possible, to the relevant state agencies and the utilities. The institutional and governance framework for electrification must therefore carefully divide responsibilities between the different agents involved.

3.4 Financial transparency & pricing

Transparency is critical where subsidies are applied. It is important that, as far as possible, such subsidies be made explicit and a system of accountability for the allocation of those subsidies be established.

Where financing mechanisms rely on internal cross-subsidisation, such subsidies are difficult to account for. Consequently, it is preferable that alternative methods be used. The closer the allocation of subsidies to the fiscus, the more transparent the system is likely to be, and the more accountable it becomes (although possibly not more responsive).

A complication with measuring and reporting the extent of subsidies arises where pricing policies allow a portion of the capital costs to be recovered through the tariffs. Under these circumstances, the level of subsidy required will inevitably be dependent on the rate of consumption growth - a variable notoriously difficult to predict. Consequently, it is important that resource allocation policies be closely linked to monitoring and evaluation exercises.

Associated with financial transparency is the need to encourage cost-reflective tariffs. Although it may be expected that electrification mostly concerns only domestic tariffs, the possible need to raise cross-subsidies, as well as ensuring the financial viability of distributors and local government, demands that attention be paid to the entire tariff system.

In principal, for reasons of economic efficiency, tariffs should be made as cost reflective as possible. Within any distribution business, some level of cross-subsidisation between and within consumer categories is inevitable. However, tariffs should be designed to reduce these within the constraints imposed by metering technology, and simplicity in tariff structure and accounting.

3.5 Monitoring, evaluation and policy formulation

The preceding discussion has, on a number of occasions, mentioned the importance of monitoring, reporting and evaluation. A system of monitoring and evaluation is

necessary not only to track progress, but also to allow ongoing and incremental adjustments to policies and implementation procedures.

4. Electrification financing

This paper is concerned with institutional and financing arrangements for electrification financing and planning. Although it is clear that many of the problems associated with electrification are linked to the existing structure of the distribution industry, it is proposed that an electrification planning and implementation system be designed to be compatible with a range of industry structure options.

It is clear that electrification cannot be optimised unless the distribution industry is rationalised in some way. Whether this rationalisation takes the form of an integrated industry, regional electricity distributors, or some hybrid of these two options (for example, Eskom subsidiaries or joint ventures) should not affect the essence of the electrification planning arrangements.

This section considers electrification financing requirements and mechanisms. The discussion will consider the types of financing requirements, the level of subsidy required, and the types of financing mechanisms which could be used.

4.1 Types of financing needs

There are three types of financing required by distribution utilities. These are as follows:

- ***Financing of commercial projects***: This concerns the investments required in upgrading existing infrastructure and expanding the networks through projects where a reasonable rate of return can be expected.
- ***Financing of non-commercial projects***: Modelling of cash flows for household electrification indicates that, even in urban areas, subsidies are required. In rural areas, the required subsidy is likely to be 100% of capital costs, whereas in urban areas it may be only a portion of the capital costs. Thus, non-commercial projects will require an element of capital subsidy to enable utilities to undertake them.
- ***Financing of operating losses***: Many electrification projects, especially those in rural areas, will incur operating losses even if all of the capital is paid by grant finance. These losses must be met from some source of finance.

> *It is recommended that the three financing requirements be met from three different sources: commercial projects should be financed from capital markets and retained earnings; non-commercial investments should be partly subsidised through grant finance; and operating losses should be covered through cross-subsidies within the domestic customer base.*

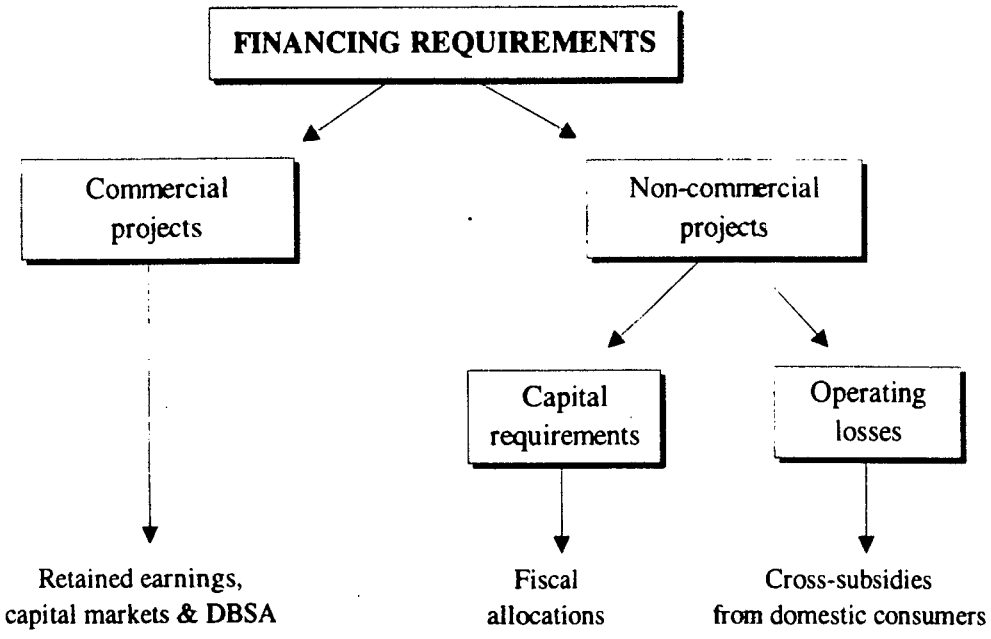

Figure 3: Financing requirements and proposed sources

Loan finance for commercial projects

It is proposed that commercial projects be financed through the capital markets and retained earnings, which represents a continuation of current practices. Financing sources include the local and international bond market, and commercial bank loans. It is proposed that the Government should not raise finance on behalf of utilities.

Complications may arise if the reformed industry structure creates new distribution entities, such as regional electricity distributors (REDs). Capital markets would be wary of new institutions and would be reluctant to subscribe to their bond issues, at least for the first five to eight years after their establishment, at least not without a substantial premium. Furthermore, the size of bond issues would probably be small (a minimum size of R200 million to R500 million is required to interest large institutional investors), and the liquidity would probably be poor (large institutions typically hold bonds for an average of six weeks, and an active market is required for this) (Moll 1996).

Alternative sources of finance are loans from commercial banks and Eskom. If Eskom has an interest in the distribution industry (for example through shareholding in REDs), then there is potential for Eskom to use its resources to raise debt on capital markets at reasonable rates, and on-lend it to the distribution industry. If these loans are targeted at commercial projects, or at least complemented with grant funds to ensure financial viability, then Eskom would be able to expect its required return on these loans with some confidence.

Should the capital markets fail to provide sufficient financing for commercial projects, possibly as a result of the difficulty in evaluation risk during a period of institutional change, then there may be a role for the Development Bank of Southern Africa (DBSA) to participate in the financing of such projects, at least during the transitional period.

> *It is recommended that commercially viable projects should be financed through standard market sources, and possibly the DBSA.*

Capital subsidy requirements

Although there will be some projects where electrification is financially viable for the utility, in most cases subsidies will be required. The total subsidy required is equal to the negative net present value of the programme - estimated at (R20 billion) for 6.1 million connections over twenty years - equivalent to (R3 250) per connection (Davis 1995). This is close to the present value of all capital investment over the same period - R23 billion - and the capital investments can be taken to approximate the subsidy requirements of the programme. Figure 4 shows these requirements over a 15 year period.

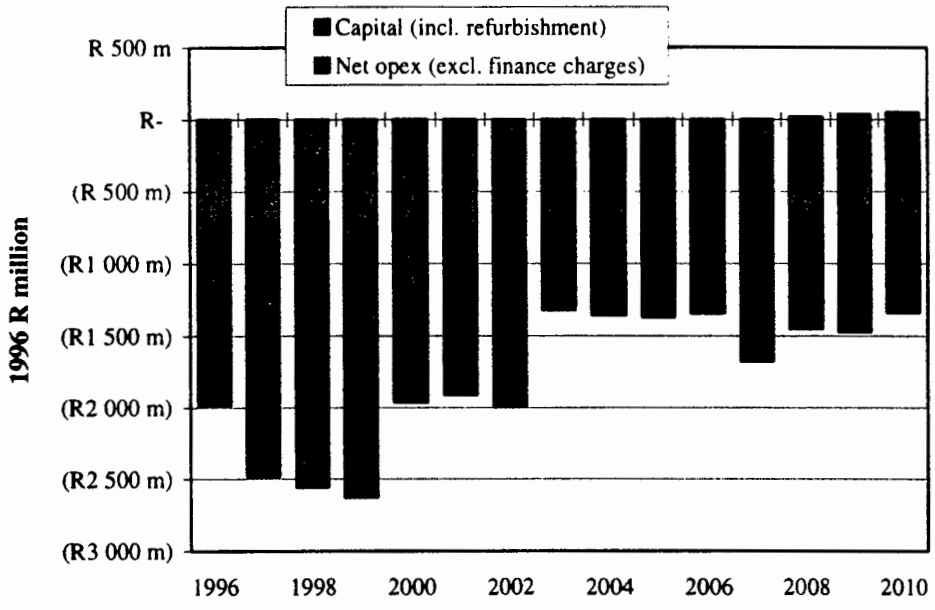

Figure 4: Subsidy requirements of the electrification programme

There are three possible mechanisms for providing grant finance to the electrification programme. These are

- internal cross-subsidisation,
- a levy on electricity sales or production, or
- allocations though the fiscus.

Internal cross-subsidisation is the method currently used. One of its disadvantages is that it is not transparent, and hence difficult to control and account for. Further, it is only available to those utilities which control a sufficient revenue base and this results in geographical and technology biases. It is certainly possible to refine the system of cross-subsidies, using the bulk supply tariff as the mechanism to spread resources between utilities and regions, but this, at best, is only an inadequate solution. Transparency is partially improved, but containing the financing within the electricity industry limits the accountability and entrenches the bias away from off-grid systems.

The imposition of a levy on electricity production or sales would certainly generate sufficient resources, and Appendix B examines the level at which such a levy would have to be set. A dedicated levy essentially amounts to the establishment of an electrification fund, which may sit within the industry or in Government. Establishing controls over such a fund would inevitably require new institutional arrangements, or impose new and substantial responsibilities on existing institutions. Further, there is likely to be resistance to a fund which does not directly benefit those who contribute to it and the scheme may face opposition from the Department of Finance as well as electricity consumers. Thus, while a dedicated levy would improve transparency, its

creation and operation may face considerable political opposition and would require new institutional arrangements to be established.

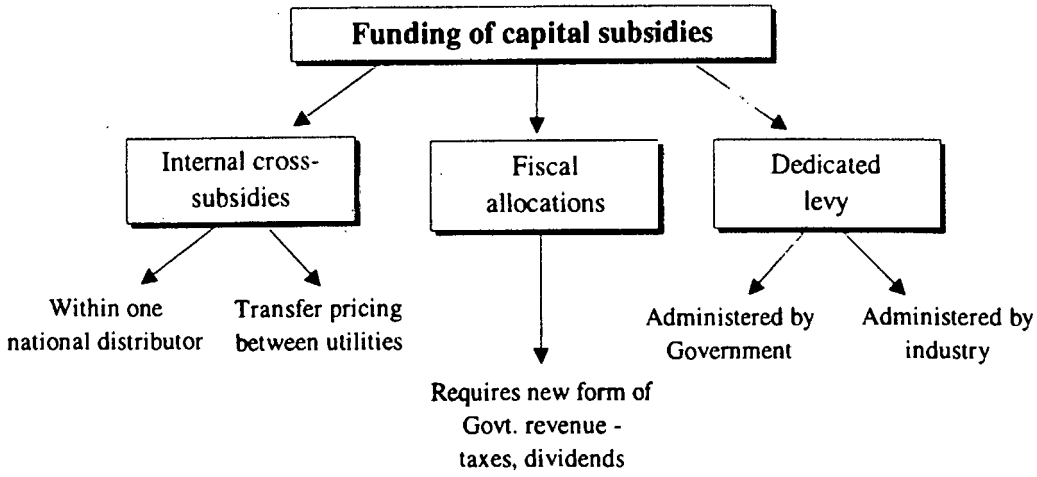

Figure 5: Options for funding capital subsidies

Fiscal allocations have the advantage that they are transparent, directly accountable to the political heads of the appropriate line departments, and must compete directly with other claims on Government expenditure. Furthermore, they ensure that Government is directly responsible for providing the financial means for achieving its policies on electrification. Utilities become accountable for implementing the policies, but the political control is firmly in the hands of Government. Changes to policy can therefore be effected directly by varying the size of the fiscal allocation.

Given the current fiscal climate, it is important that the introduction of a new Government expenditure item should be matched with new forms of revenue generation. That is, the net effect on the fiscus of new expenditure and new revenue should be zero. New Government revenues can be generated by taxing the electricity industry which, to date, has been exempt from taxation and has passed profits from electricity supply either to other services (in the case of local authorities) or to consumers in the form of lower tariffs (in the case of Eskom). Appendix B shows that the imposition of companies tax and a 33% dividend policy would raise considerable resources from Eskom - close to the total amount required for electrification.[1] Since Government may wish to introduce such a tax and dividend policy on all public enterprises as part of its restructuring of state assets, electricity utilities may have to contribute to the fiscus anyway, regardless of electrification financing.

> *It is recommended that subsidisation of capital expenditure on electrification be achieved through fiscal allocations and that a companies tax and dividends policy be applied to raise the necessary fiscal resources.*

A subsidy mechanism requires appropriate institutional arrangements to administer, govern and evaluate the application of the subsidy. Section 5 addresses these issues.

Cross-subsidies for operating losses

Many electrification projects will have to sustain operating losses. It is proposed that cross-subsidies, mainly within the domestic consumer base, be used to meet these losses. These subsidies will largely flow from urban consumers to rural consumers. For this mechanism to work, careful consideration must be given to the regional boundaries of REDs (if created), and the level of domestic tariffs.

At present, domestic tariffs vary widely. The NELF[5] recommendations to cabinet proposed that there should be a single national domestic tariff (NELF 1994). At present, the prepayment tariff used in most electrification projects, at 25c/kWh, is much higher than the average domestic tariff, at 17c/kWh. This is largely due to the capital redemption portion built into the prepayment tariff.

In the case of a national electricity distributor, cross-subsidies can easily be distributed across the country. If, however, REDs are created, complications may arise. It may be that the RED boundaries can be arranged to ensure that a national domestic tariff can cover the cross-subsidy requirements of rural households in all REDs, without generating excess surpluses in any RED. It is unlikely that this problem will be solved through boundaries alone, however, particularly during a period when the rural customer base is expanding rapidly. If this proves to be the case then two solutions are possible. Either the concept of a national domestic tariff must be replaced by regional tariffs, thereby allowing REDs to set their domestic tariffs at a level to meet their revenue requirements; or an equalisation mechanism, such as differential bulk supply tariffs, must be designed. In principle either mechanism would suffice, but in practice the latter would likely prove difficult to regulate.

> *It is recommended that cross-subsidies within the domestic consumer base be used to meet operating losses on electrification projects. Regional domestic tariffs should be set to raise sufficient revenue to do this.*

5. Institutional arrangements

Institutional arrangements for the allocation of grant finance to the capital costs of electrification need to achieve the allocation of grants, the monitoring of the subsidised electrification programme, and the reformulation of electrification policies. Each of these is discussed below.

5.1 Allocation of grant finance

Institutional arrangements for the allocation of grant finance are inevitably closely linked to the mechanism of finance adopted. Ultimately the choice is between a system which keeps the financial flows within the electricity industry, and one which allows funding to flow through the fiscus.

[5] National Electrification Forum

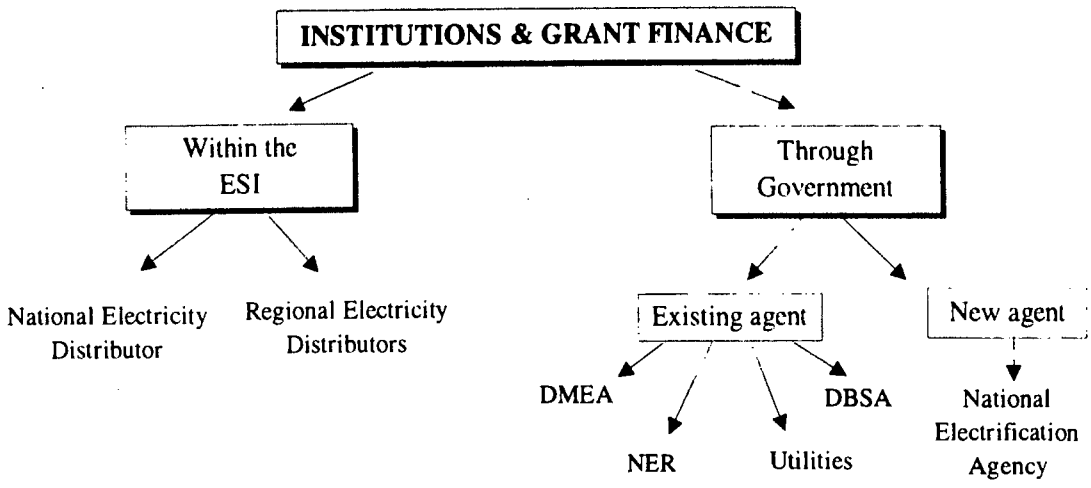

Figure 6: Institutional options for allocating grant finance

If the financing is maintained within the industry, then the allocation processes and associated institutions will depend on the structure of the industry. In the case of a horizontally integrated distribution industry, it is possible for cross-subsidies to be contained wholly within such a utility. If, however, the distribution industry comprises more than one utility (for example, a set of regional electricity utilities), it will be necessary to utilise a mechanism such as transfer pricing to manage financial flows between utilities. It would be unreasonable to expect the industry to determine the extent of such transfers itself, and hence it would be necessary to achieve these transfers through bulk prices. Given that the NER is responsible for regulating prices, it is likely that such a function would be best undertaken by the regulator (although this has the potential to undermine other functions undertaken by the regulator).

The disadvantages of this system are that, firstly, transparency is not significantly improved and, secondly, Government's policy instruments remain limited. Furthermore, the high level of cross-subsidisation required would limit the extent to which other structural reforms in the electricity industry could be introduced.

If the proposed system of fiscal allocations is adopted, then it will be necessary to decide which institutions should be involved in making the allocations. Here the choice is between the Department of Finance allocating funds to an existing agent, or allocating them to a new institution. The magnitude of the task should be emphasised. If grants cover 100% of the costs of rural electrification and 50% of the costs of urban electrification, then the total annual disbursement, at least in the next few years, will be of the order of R1.7 billion per annum. This is more than the R1.4 billion which the DBSA disbursed in loans last year.

Existing agents which may be considered for managing the allocation of grant funds include the DBSA, NER, and the DMEA. The DBSA is a development finance institution (moving towards becoming an infrastructure financing agency) and is probably well placed to manage electrification funding, although this responsibility may conflict with the DBSA's role as a loan finance institution. The NER has as one of its responsibilities the monitoring of electrification. The task of grant allocation would, however, be well beyond its current administrative capacity and would also tend to confuse its regulatory and monitoring functions with that of resource allocation. Lastly, the DMEA is the state department tasked with developing and executing Government's energy policies. Locating the function of grant allocation within this department therefore seems appropriate. It must be recognised though that in the current context of civil service reduction the DMEA faces significant capacity constraints, which may limit its ability to actually undertake the allocation function.

Given the capacity constraints within the DMEA the option of establishing a new National Electrification Agency appears attractive. When the practical difficulties of establishing a new institution are considered though this option appears less attractive. It is therefore concluded that the optimal arrangement is a combination of the DMEA retaining responsibility for allocation, perhaps within a Directorate: Electrification, but using an external resource to manage the operational processes.

> *It is recommended that grant finance allocation be the responsibility of the DMEA, which may choose to contract out the management of the allocations to a private, non-government or quasi-government agency.*

5.2 Monitoring and evaluation

It is essential that the implementation of the electrification programme be monitored and the impact of the programme evaluated. Electrification policies should be continually reformulated to clarify the goals of electrification and to develop indicators to evaluate progress.

There are a number of organisations who would be in a position to contribute to the monitoring and evaluation of the programme. Firstly, there are the utilities themselves who will be able to report on the implementation of electrification projects. Secondly, there is the NER, which has as one of its functions the monitoring of utilities' electrification programmes. Thirdly, there is the DMEA, which is concerned with evaluating the effectiveness and impacts of its electrification policies. Finally, should the above recommendation on the allocation of grant finances be implemented, there may be an agent which manages the operational aspects of electrification subsidy allocations.

> *It is recommended that electrification be monitored from as many angles as possible, and that all appropriate agencies should contribute to this. The utilities the NER and the allocating agent should focus on monitoring implementation, whereas the DMEA should have primary responsibility for evaluating the impacts of the programme.*

5.3 Policy formulation

It is important to distinguish between those policy domains which concern Government and those which that lie within the jurisdiction of utilities, even though there will always be some grey areas which concern both Government and utilities.

Government's electrification policy concerns relate issues such as the establishment of targets and guidelines for the allocation of grant finance. Electrification targets are closely linked to the availability of adequate funding, and it is Government's responsibility to set targets in conjunction with the establishment of suitable and adequate financing mechanisms. Having established such mechanisms, Government needs to provide guidelines for the allocation of grant funds.

It is essential that Government, through the DMEA, should integrate monitoring and evaluation outcomes into the overall policy formulation process. Thus the results of evaluations should be closely linked to the establishment of new targets and changes to resource allocation guidelines.

Utilities should be primarily concerned with policy issues which relate to the implementation of the programme. This includes the selection of technology,

connection and tariff policies, as well as the details of network expansion planning. Government should, through the NER, ensure that utility implementation practices match Government's overall policies.

> *It is recommended that the DMEA be responsible for formulating policies which establish the orientation of the electrification programme, whilst utilities should be responsible for establishing policies concerned with the implementation of electrification. The NER should be responsible for ensuring that the utilities' practices are in accord with Government's overall policies.*

6. Electrification targets and resource allocation guidelines

This section discusses the level at which electrification targets may be set, and presents some proposals for resource allocation guidelines.

6.1 Electrification targets

RDP electrification targets have already established until 1999, requiring a peak connection rate of 450 000 per annum. If these targets are met, this will increase the overall level of access to electricity from its current level of 50% to around 65%. At that point it is likely that most of the remaining three million unelectrified households will be in rural areas, and that rural access to electricity will remain below the 50% mark.

The National Electrification Economics Study (NEES) medium scenario provides a set of connection rates which should ensure that overall levels of electrification reach approximately 80% by 2010 (assuming a household formation rate of 2%). These connection rates, and the resulting level of access to electricity, are shown in appendix A (Figure 7). It can be seen from this figure that an annual connection rate of close to 200 000 is close to a household formation rate of 2% per annum, and this should therefore be taken as the minimum target level for household electrification.

Although these figures comprise possible long term targets which Government may wish to set for the electrification programme, it is important that firm targets be set for the medium term only, and that targets be extended on an annual basis. This will allow Government to make changes to the pace of the programme, depending on a number of factors, such as the economic growth rate, the availability of grant finance, the financial performance of utilities, and the rate of household formation.

> *It is recommended that electrification targets be established as part of a five year rolling plan, initially based on the NEES medium scenario. Targets should be adjusted on an annual basis to take account of changing circumstances.*

6.2 Resource allocation guidelines

Government should provide guidelines for the allocation of grant funds to electrification. It is proposed that the system operate on the basis of competitive bids for funding. These bids should be evaluated in terms of a set of criteria designed to orientate electrification towards achieving Government's policies. It is proposed that a combination of efficiency and equity considerations be adopted:

> ***Regional equity***: Some funds should be allocated to ensure that electrification levels in all provinces reach certain targets. It is proposed that a minimum target of 50% access to electricity in all provinces by 2011 should be adopted. This rule

would favour electrification projects in rural areas. Appendix C details the number of connections and costs for each province in order to meet this target.

Economic efficiency: Projects should be subjected to an economic evaluation to prioritise projects on the basis of net present value. This rule would favour low cost projects, and projects which are more closely linked to productive uses of electricity.

It is proposed that utilities be tasked with the responsibility of planning electrification programmes to meet certain minimum targets and that project selection and prioritisation be undertaken by these utilities in close consultation with provincial and local government. Utilities should then apply for public funding for these programmes through grant allocation channels.

Bids for funding should be evaluated on the basis of the above two criteria, being equity and economic efficiency. It is likely that urban projects will benefit from this allocation procedure, as their costs are lower and their benefits are generally more diverse in urban locations. Well prepared development plans for rural areas will clearly also receive attention for funding because of the equity criteria.

It should be stressed that the allocation of grant funds should not be limited to electricity utilities, but should also be available to institutions disseminating non-grid applications and communities seeking funding for off-grid energy supplies. An important example is REFSA's[6] solar home system dissemination programme, which should be eligible for subsidisation. Such agencies can compete directly for funding, and utilities may contract a portion of their funding allocations to these agencies in order to meet connection targets within funding constraints. This approach should result in innovative strategies and partnerships, leading to the overall stimulation of the renewables industry.

In order to ensure that utilities adopt cost-minimising strategies, it is proposed that electrification grants cover only a proportion of the investment requirements in urban areas (so that utilities share the risk), and that capital limits be set per connection for grants in rural areas (to stimulate cost-minimising strategies).

Grant allocations will therefore encourage utilities and other agencies to put together innovative financing strategies. Combining grants with commercial financing and possibly even other grant sources (such as the clinic electrification funding available from the Independent Development Trust - IDT) should be encouraged.

> *It is recommended that grant funds be allocated to electrification programmes using criteria which combine both equity and efficiency objectives. Allocations in urban areas should cover a proportion of capital costs, and in rural areas a cost per connection limit should be set.*

7. Conclusions

It is apparent that existing institutional and financing arrangements in the electricity supply industry are unsatisfactory for a variety of reasons. At present the programme is driven by targets which focus on the numbers of households electrified, and is seriously constrained by institutional and financing arrangements which distort the system of

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[6] Renewably Energy for South Africa Pty Ltd, a subsidiary (public sector) company of the Central Energy Fund with the task of financing renewable energy projects in South Africa. REFSA's first task relates to the financing of solar home systems in rural areas.

resource allocation. Unless reforms are introduced, it is very possible that the electrification programme will falter after the year 2000, leaving many regions of the country with low levels of access to electricity.

Electrification is expensive, capital intensive and cannot be financially viable without substantial subsidies. The net present value of an unsubsidised electrification programme, based on the NEES medium scenario, is in the region of negative R3 250 per connection. The level of subsidisation required to make the programme financially viable varies between R1 billion and R2 billion per annum over the next 15 years. Electrification already imposes costs of this order on the system, resulting in higher electricity tariffs than would otherwise be possible. This paper recommends that the position of state owned electricity enterprises be "normalised" as tax and dividend paying companies and that income derived from these changes be used to fund electrification.

This paper has also proposed a set of institutional and financing arrangements which, if adopted, should ensure that electrification continues without adversely affecting utilities' financial positions. The recommendations assume that the distribution industry will be rationalised. Electrification financing should then be separated from the industry's structure through the establishment of subsidy mechanisms together with appropriate institutional arrangements.

It is useful to compare the paper's recommendations against the five objectives for electrification policy set out in section three. Electrification incentives will be provided through a linked system of targets and capital subsidies. The proposed system of monitoring, evaluation and policy reformulation will also ensure that targets are flexible enough to respond to changing conditions. Although targets and financing mechanisms constitute a "top-down" approach to electrification, utilities will be encouraged to plan their electrification programmes in a demand-driven manner and allocations will be made on the basis of competitive bids.

Incentives to reduce costs are provided through a combination of mechanisms. Firstly, capital subsidies in urban areas will contribute only a portion of the total investment required, thus reducing but not removing the utilities' risks. In rural areas, a subsidy limit will ensure that utilities explore cost-minimising options, particularly the option of solar home systems. Lastly, operating losses will have to be met through cross-subsidies and the utilities will face the risk of the NER disallowing tariff increases if cost-minimising options are not explored sufficiently.

As they stand, these recommendations constitute a system which moves away from the *status quo*, where the industry controls and manages the entire electrification programme, towards a system which involves the minimum of institutional changes. Care has been taken to minimise the creation of new institutions. Instead the recommendations have attempted to maximise the use of existing capacities and institutional resources within the ESI and Government. This should minimise disruption and ensure the continuation of progress with the electrification programme.

One of the strengths of these recommendations is that they clearly identify the key functions involved in electrification and allocate these responsibilities to appropriate institutions. Utilities are tasked with implementing Government's electrification policies, and are relieved of having to take responsibility for the policy orientation of the programme and the allocation of large subsidies. Government is clearly tasked with the responsibility for developing policies and providing resources and financing

mechanisms to ensure that its policy objective of household electrification can be attained.

The subsidisation of electrification through fiscal allocations will be substantially more transparent than the current system. It will be clear where electrification funds come from, and the electrification programme will have to compete with other development objectives for funding. Similarly, electricity prices will have most of the electrification subsidy element removed (although other subsidies, such as environmental components, will remain), and will therefore become more cost-reflective, thus providing better pricing signals to the market. The imposition of company taxes and dividends on the electricity industry will also remove a market distortion which currently favours electricity over other fuels. This will be particularly important as natural gas is introduced into the South African energy economy, and if private sector participation is ever contemplated in the electricity generation industry.

Lastly, the recommendations include a system of monitoring and evaluation of electrification that maximises the use of existing institutional strengths and natural institutional roles. The DMEA is tasked with the overall responsibility of ensuring that the outcomes of these evaluations are integrated into the policy formulation process. Given the size of this task it may be necessary to create a dedicated Directorate: Electrification within the department.

Implementation of these recommendations will entail significant restructuring of financing and institutional arrangements, and clearly there is much detail to be filled in. Nonetheless the main objective of this investigation has been achieved in proposing an electrification policy framework and demonstrating that it is both desirable and workable. In short, we believe that the implementation of these recommendations will lead to an appropriate distribution of power.

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Appendix A
Review of electrification to date

Since the inception of Eskom's electrification programme in 1991, household access to electricity has been substantially increased. The data presented below summarises key electrification statistics, targets set for the industry, and progress made to date.

Electrification statistics

It is estimated that at the end of 1995 there were close to 9 million households in South Africa with an average size of 4.6 people (NER 1996). Of these households, 50% were estimated to have access to electricity, equivalent to 46% of the total population. If 'rural' is defined as all households outside proclaimed towns and cities, the rural population accounts for approximately half of the total population. Within this rural group, 21% of households have electricity, although this is a significant increase since 1994 when only 12% were estimated to have electricity. The provincial breakdown is given in Table 3.

Table 3: National electrification statistics - December 1995
Source: NER 1996

Province	Population[1] (000)	Households (000)	Percent[2] Rural	Unelectrified houses (000) Urban	Rural	Total	Access to electricity[3] Urban	Rural	Total
K/Natal	8 582	1 796	60%	172	849	1 021	79%	14%	43%
E Cape	6 625	1 393	68%	162	846	1 008	67%	6%	28%
Gauteng	7 143	1 751	4%	375	31	406	78%	54%	77%
Northern	5 148	1 055	91%	34	715	749	71%	24%	29%
W Cape	3 851	933	15%	95	72	167	88%	47%	82%
North West	3 523	710	69%	69	382	451	70%	21%	36%
Free State	2 801	599	46%	116	163	279	68%	33%	53%
Mpumalanga	2 968	589	70%	79	247	326	59%	37%	45%
N Cape	810	183	33%	29	34	63	76%	47%	66%
Total	**41 451**	**9 009**	**51%**	**1 131**	**3 339**	**4 470**	**76%**	**21%**	**50%**

1 These figures exclude people living in institutions (hostels, old-age homes, etc.)
2 Based on population ratios, not housing ratios.
3 Based on housing ratios. Statistics based on population ratios are slightly lower.

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.

It can be seen in Table 4 that the level of electrification in formal urban housing is relatively high - close to 80% nationally (in December 1994). It is in informal areas that urban electrification levels are low and it is expected that electrification in urban areas will be aimed primarily at these groups of residents.

Table 4: Breakdown of urban electrification by housing category - 1994
Source: Eskom-NELF 1995

Urban housing type	Houses	Electrified	Not electrified	% electrified
Formal housing	3 500 000	2 700 000	800 000	77%
Institutions[1]	285 000	250 000	35 000	87%
Informal housing	714 000	224 000	490 000	31%
Informal backyard dwellings	147 000	36 000	111 000	25%
Total	**4 646 000**	**3 210 000**	**1 436 000**	**69%[2]**

1 Institutions refers to clinics, hospitals, prisons, etc.
2 Total urban electrification had increased to 76% by the end of 1995 (NER 1996)
Note: Figures are rounded to the nearest 1 000.

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 many families without electricity reside on farms which have a supply point. The costs of extending electricity to this group are likely to be relatively low.

The electrification of all schools and clinics has been identified as a priority by the Government - the Reconstruction and Development Programme (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 19 000 schools without access to electricity (NER 1996) - equivalent to an electrification level of 24%. The equivalent figure for clinics is less certain - the NER (1996) states that there are some 2 200 clinics without electricity, whereas the IDT (1995) states that there are only 900 major clinics (as opposed to visiting points) without electricity (out of a total of 3 000 clinics in the country), and this figure includes all those sites where electrification is planned or currently being undertaken. The costs of electrifying all these sites is estimated at R50 million (IDT 1995). In addition, a further 250 new clinics will have to be electrified.

Electrification progress to date

Eskom embarked on an electrification programme towards the end of 1991. The subsequent formation of the National Electrification Forum (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, and the associated level of access to electricity are presented in Figure 7. Current commitments by Eskom as well as targets set by the Government, extend up to the year 2000.

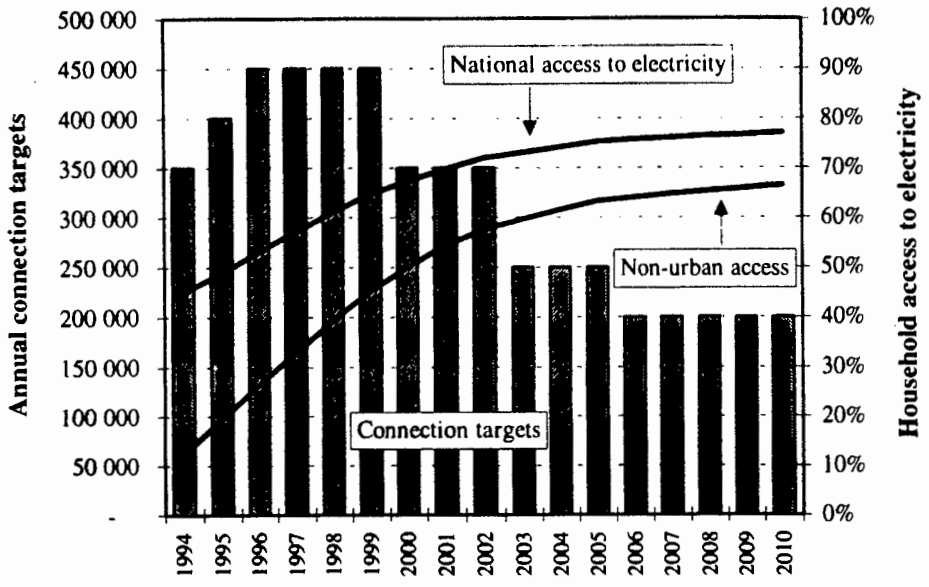

Figure 7: Household electrification targets and projected access to electricity

Given the estimated rate of household formation, and the existing level of electrification, these targets should lead to an increase in access from 50% of dwellings in 1995 to 65% in 2000 (Theron 1995). However, most of the remaining unelectrified households will be in rural areas. 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 approach 80% by 2012 (Van Horen 1994).

Table 5 summarises the achievements of the entire electrification programme to December 1995.

Table 5: Electrification progress to December 1995
Sources: NER 1996, Eskom 1995 and Foccaracio 1996

	1991/2	1993	1994	1995	Total
Eskom prepayment connections	177 000	209 000	254 000	313 000	953 000
Local government connections	93 000	91 000	130 000	118 000	432 000
Other	21 000	16 000	35 000	32 000	104 000
Farmworker connections	0	16 000	17 000	15 000	48 000
Total	**291 000**	**332 000**	**436 000**	**478 000**	**1 537 000**
Eskom capex (R million)	R472m	R584m	R808m	R1 055m	R2 919m
Eskom capex per connection	R3 036	R2 799	R3 179	R3 370	R3 162

Note: figures are rounded to nearest 1 000

Responsibility for the electrification of schools and clinics has been shared between Eskom and the Independent Development Trust (IDT). The IDT has estimated that the total cost of electrifying all major clinics in the country is R50 million, and has allocated sufficient funds to achieving this. By July 1995, the IDT had electrified over 250 clinics, equivalent to 30% of the total needs at the start of their programme.

In 1995 Eskom electrified close to 1 000 schools (NER 1996). School connections are made in one of three ways: (1) as part of the general grid extension programme, and so funded by Eskom; (2) as part of the schools electrification drive, funded by Norwegian grants and the Eskom Community Development Fund; and (3) part of the off-grid electrification programme, funded by RDP grants.

Appendix B
Revenue from taxation, dividends and levies

It can be seen that grant finance requirements peak at over R2 billion per annum, and decline to between R1 billion and R1.5 billion over the next fifteen years. It should be stressed that at present these requirements are being met from within the electricity industry - Eskom has been spending around R1 billion per annum, with municipal distributors also investing substantial amounts in electrification. In essence, the recommendation is to extract these resources from the industry, and reallocate them through other mechanisms. The options for extracting the resources include the following:

- Company tax and dividends on Eskom and distribution authorities,
- An electrification levy on electricity sales or production,
- A combination of taxes/dividends and a levy.

At present Eskom is exempt from paying tax in terms of section 24 of the Eskom Act, 1987. Although accounts for taxation purposes are slightly different from the financial statements published by Eskom, it is possible to make an estimate of Eskom's taxable income. It can be seen from Table 8 that if Eskom paid tax, this would amount to around R1.2 billion per annum[7]. If a dividends policy of 33% were applied, then a further R500 million would be raised (based on Eskom's 1995 accounts).

Table 6: Estimates of tax/dividends from Eskom [R million]

	1995	1994	1993	1992
Net income	R 2 716	R 2 268	R 1 646	R 1 487
Taxable income[1]	R 3 341	R 3 014	R 1 832	R 1 699
Tax @ 35%	R 1 169	R 1 055	R 641	R 595
Net income after tax	R 1 547	R 1 213	R 1 005	R 892
33% dividends	R 516	R 404	R 335	R 297
Total taxes & dividends	R 1 685	R 1 459	R 976	R 892
Total taxes & dividends [1996 R]	**R 1 685**	**R 1 575**	**R 1 148**	**R1 155**
Taxes & dividends / utility revenue	10%	10%	7%	7%

1 Adding back provisions for nuclear waste management, management rationalisation, post-retirement medical benefits and 75% of provisions for arrear debts.

Thus it can be seen that taxes and dividends would meet a large portion of electrification subsidy requirements, certainly in the latter half of the programme when funding requirements decline. If non-Eskom distributors also pay taxes and dividends, then fiscal revenues will be even greater. Surpluses from municipal electricity departments have been in the region of R1.7 billion per annum, and if this surplus was taxed it may be expected that substantial additional revenues would be received by the fiscus.

The imposition of taxes and dividends on the electricity industry will have mixed implications for electricity prices. Although it may be expected that utilities would have

7 It should be stressed that these are estimates only. Tax revenues would be sensitive to a number of factors, most important of which is the period over which assets could be depreciated for tax purposes. At present generation, transmission and distribution assets are depreciated over 25 years, and if the Receiver of Revenue allowed shorter life-times, then the tax payable would be decreased.

to increase prices to meet financial targets, this increase would be offset by the reduced obligation to subsidise electrification. Thus, the necessary price increases would be reduced substantially. Assuming that taxation of Eskom and the payment of dividends is introduced together with public subsidies towards electrification (so relieving Eskom of capital expenditure in the order of R1 billion per annum), then Eskom would have to raise approximately R700 million in additional revenue in order to maintain its debt:equity targets. This equates to an average price increase of 0.5c/kWh - an increase of 4.5% over the average price of electricity sold in 1995.

If an electrification levy is applied to raise the necessary subsidy resources, this levy can either be applied at the generation or the retail level. The advantages of imposing the levy on generation are that revenues are relatively easy to collect, and secondly that Eskom may be in a position to absorb a portion of the levy, so reducing the effect on end-users. However, a policy of spreading the burden of the levy unequally among different consumer groups may be preferred, particularly as many industries are dependent on low electricity prices. Consequently, it is possible that Government may prefer that domestic consumers carry all, or a disproportionate portion of any levy. This policy may be implemented by opting for a levy on retail sales rather than generation, or by regulating the way in which utilities recover the cost of the levy from consumers.

The levy can operate in one of two ways. A ***fixed levy*** would impose a fixed percentage surcharge on all electricity sales. The levy would be calculated to ensure that, on average during the period of the electrification programme, all subsidy requirements are met. This would mean that in the early years of the programme the levy would raise less than the subsidy required, and in later years it would raise more. Debt would have to be raised to meet the short term requirements in excess of the resources generated from the levy. On the other hand a ***declining levy*** could be designed to be high in the early years, and then decline to zero by the end of the programme. Any excess funds generated would be used to fund electrification requirements during the years when the levy is very low.

Figure 9 illustrates the way in which these two levies would be implemented as a surcharge on all electricity sold. The declining levy starts at 1.28c/kWh - equivalent to an 11% average price increase - and declines over time to 0.42c/kWh - a 3% price increase. If consumption grows at a slower rate than the 5% assumed, then the rate at which the levy declines will be slower. If a fixed levy is charged, then this would be set at 6.5% - a 0.78c/kWh charge.

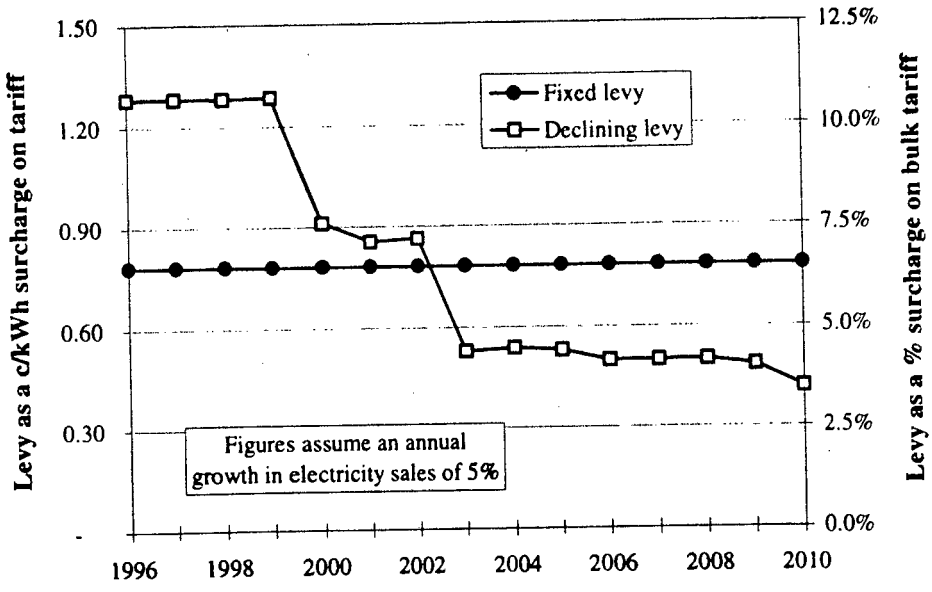

Figure 8: Declining and fixed levy imposed on electricity sales

A fixed levy should preferably be avoided, due to the need to raise additional finance. It is possible that during the years of deficit Eskom, or the DBSA, could raise debt and on-loan to the distribution industry. However, this arrangement is probably unnecessarily complicated.

The declining levy is preferred over the fixed levy, even though it imposes a relatively high burden in the early years of the programme. There is likely to be wider acceptance of a levy which is guaranteed to decline in real terms every year.

It should be noted that an electrification levy and a tax/dividend policy on utilities are mutually exclusive options if substantial price rises are to be avoided.

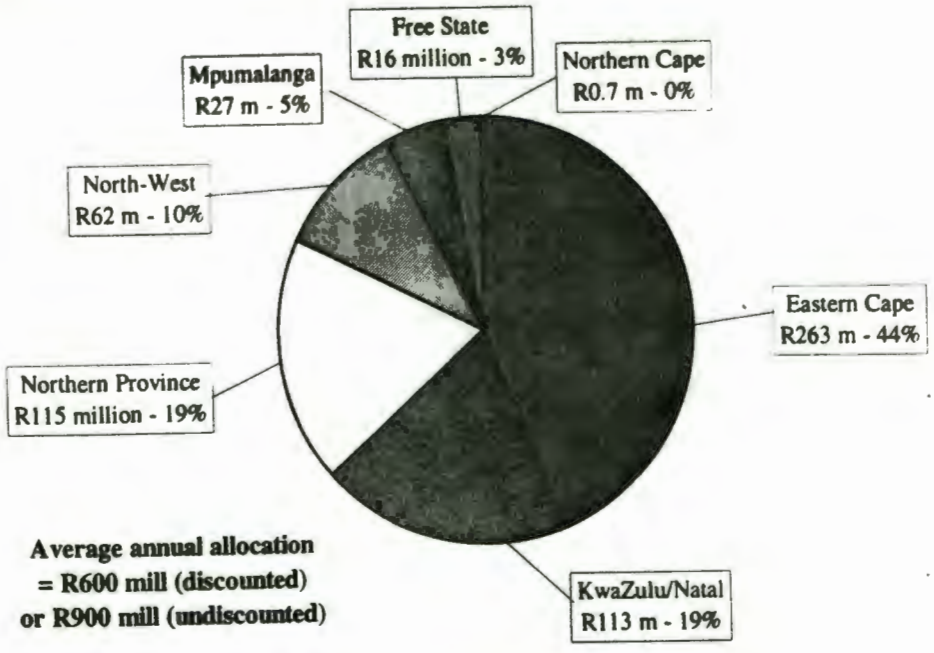

Figure 10: Average annual allocations to provinces
(discounting future allocations by 6% (real) per annum)

Appendix C
Connections and costs required to reach 50% access to electricity in all provinces

In order to illustrate the scale of electrification, Figure 10 shows the number of connections which would have to be made on an annual basis if access to electricity in every province is to reach 50% by the year 2010. It can be seen that the Eastern Cape, KwaZulu/Natal and the Northern Province must undertake three quarters of connections (30%, 23% and 21% respectively). Electrification levels in the Western Cape and Gauteng are already higher than 50%.

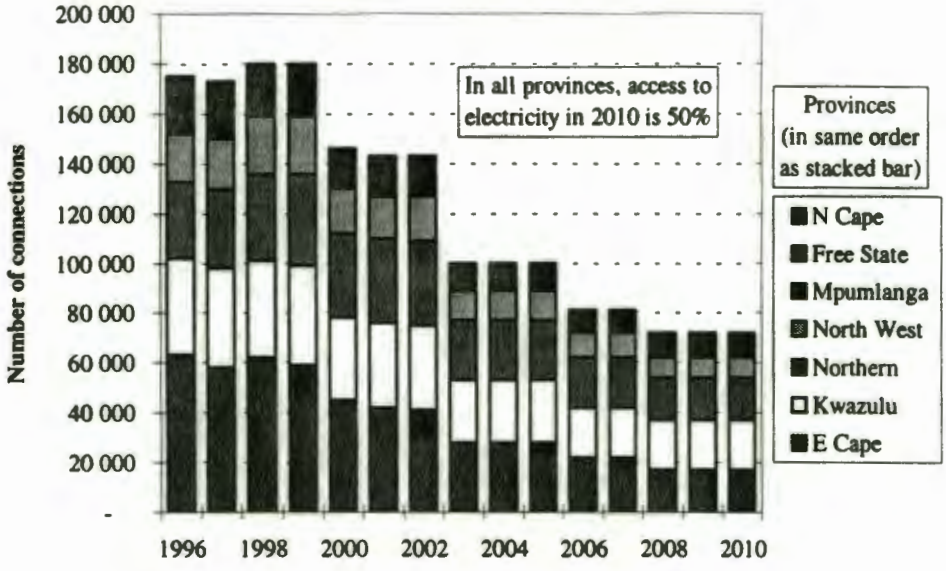

Figure 9: Number of connections required to reach 50% access to electricity in all provinces

The capital expenditure required to reach these targets is shown in Figure 11. On average, the expenditure is R900 million per annum. Of this expenditure, the three provinces of Eastern Cape, KwaZulu/Natal and Northern Province account for 82%, and the Eastern Cape alone accounts for 44% of all expenditure. The provinces of North West, Mpumalanga and Free State receive a small but significant portion of the allocations, the Northern Cape receives only a very small portion and Gauteng and the Western Cape receive none at all.

It should be noted that these figures exclude the possibility of a limit on costs per connection. Rural connection costs in the years after 2000 are likely to be well in excess of R5 000 and if limits are imposed this will have a significant effect on subsidy requirements. Such a limit will force utilities to use off-grid technologies in a substantial way, raise funds in addition to subsidy resources, or reduce their electrification programmes. Such a trade-off will inevitably be difficult to make.

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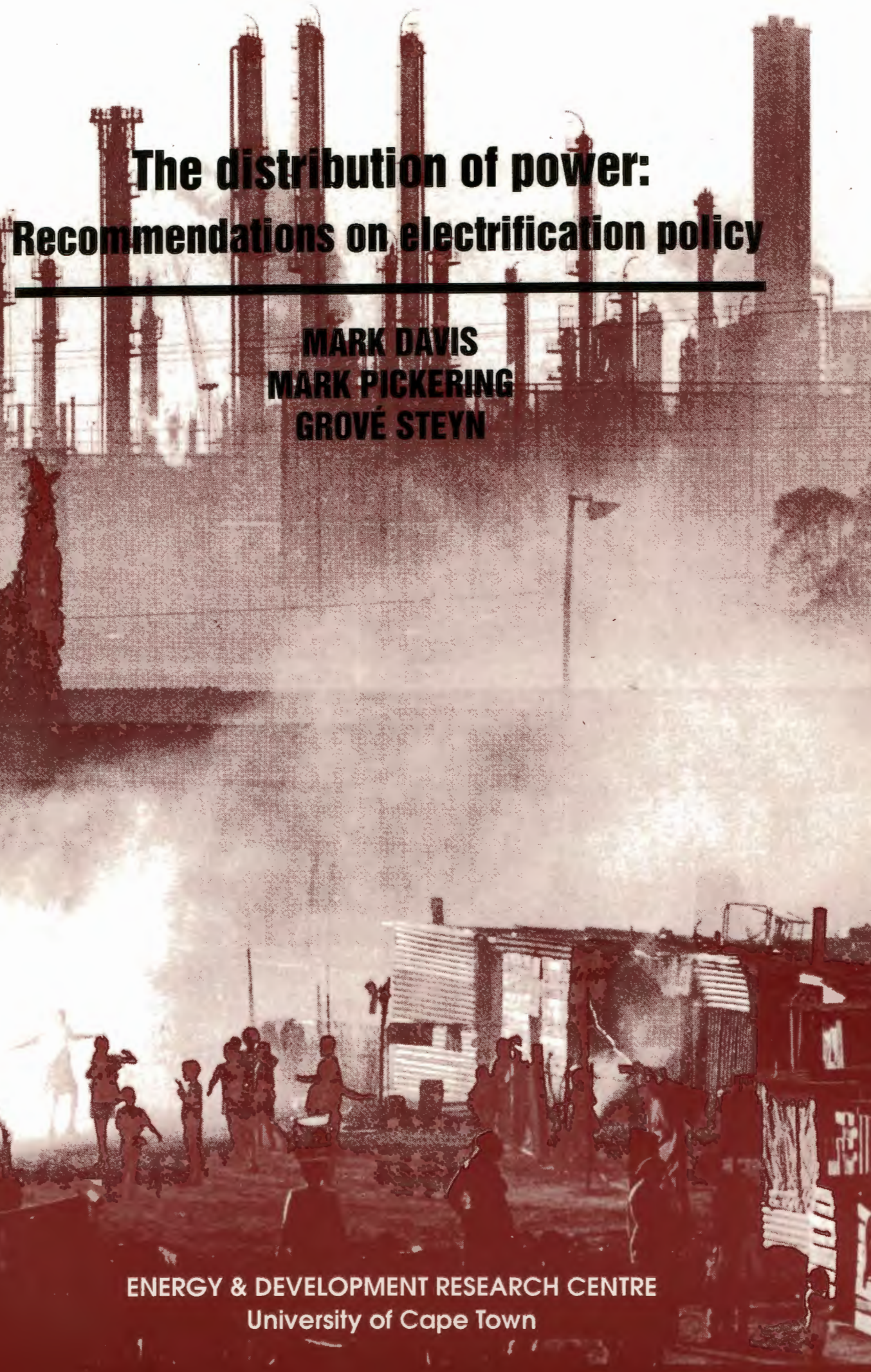

The distribution of power:
Recommendations on electrification policy

MARK DAVIS
MARK PICKERING
GROVÉ STEYN

ENERGY & DEVELOPMENT RESEARCH CENTRE
University of Cape Town