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FINAL REPORT

DEVELOPMENT OF A DRAFT MANUFACTURING AND MINING ENERGY EFFECTIVENESS STRATEGY FOR SOUTH AFRICA

PART 3: A STRATEGIC PLAN FOR IMPROVED INDUSTRIAL ENERGY EFFECTIVENESS IN SOUTH AFRICA

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ABSTRACT

In the past energy effectiveness in South Africa has been left to market forces, whilst the government has focussed on supply. However a number of barriers exist in South Africa preventing the optimum allocation of resources. Similar barriers have been identified in other countries and many of these barriers have been overcome by government through the implementation of an energy effectiveness strategy. The purpose of this study is to propose an appropriate industrial energy effectiveness strategy for South Africa.

It is proposed that a strong central energy effectiveness group be expanded from the Electric Energy Directorate of the Department of Mineral and Energy Affairs. Various bodies can be involved in the implementation of the strategy, including energy suppliers, equipment manufacturers/suppliers, tertiary education bodies, energy service companies, energy auditors and consultants, and government. It is the task of the energy effectiveness group to decide on the role to be played by each body and how each should become involved, and then stimulate the necessary involvement.

On the supply side, issues requiring attention are the promotion of energy carriers, which is currently heavily weighted towards electricity, and the promotion of energy effectiveness by suppliers. In addition, little effective regulation or profit incentive exists for utilities to apply integrated resource planning, and this necessitates the appointment of a working group to examine integrated resource planning in the South African context. Little is known of externality costs, such as environmental costs, in South Africa and an action plan in this respect should be developed.

The role of government in industrial energy effectiveness should be catalytic and therefore the promotion of energy awareness and the provision of information should be the main focus government strategy. Proposed government actions include the creation of a national energy database, publication of an energy management manual, development of an energy effectiveness training programme, and the introduction of boiler testing, energy audit, sectorial audit, and demonstration schemes. It is estimated that R 1,2 million will be required over the next few years to develop methodologies for each of the above programmes. In the medium term the proposed schemes could cost R 6,6 million/annum and, including research assistance and salaries of the energy effectiveness group, the total cost to government would be R 9,4 million/annum. It is conservatively estimated that the medium-term saving of this strategy will be R 483 million/annum.

EXECUTIVE SUMMARY

In the past energy effectiveness in South Africa has been left to market forces, whilst the government has focussed on supply. However a number of barriers exist in South Africa preventing the optimum allocation of resources. Similar barriers have been identified in other countries and many of these barriers have been overcome by government through the implementation of an energy effectiveness strategy. The purpose of this study is to propose an appropriate industrial energy effectiveness strategy for South Africa.

Industry is an important sector for energy effectiveness focus because such a large potential for improvement exists. It has been estimated that R1,1-1,8 billion/annum (9-12% of industrial energy expenditure) could be saved by 2005 through cost-effective improvements. Public funding for energy effectiveness in energy effective countries for the whole economy, excluding research funding, is typically 0,05-0,5% of total energy expenditure. If South Africa's public funding for energy effectiveness were 0,2% of total energy expenditure, then R92 million/annum would be required. It is unlikely that such funding will be forthcoming in the near future, and these financial constraints were borne in mind when designing an industrial energy effectiveness strategy.

An energy effectiveness strategy can only be successfully planned, implemented, and evaluated if the necessary institutional structure exists. A strong central energy effectiveness group is required for planning and evaluation. It is proposed that such a group be expanded from the Electric Energy Directorate of the Department of Mineral and Energy Affairs. Various bodies can be involved in the implementation of the strategy, including energy suppliers, equipment manufacturers/suppliers, tertiary education bodies, energy service companies, energy auditors and consultants, and a government implementing agency. It is the task of the energy effectiveness group to decide on the role to be played by each body and how each body should become involved, and then stimulate the necessary involvement of each body.

Two problems exist on the energy supplier side, namely, (1) promotion of energy carriers is heavily weighted towards electricity, and (2) no energy supplier adequately promotes energy effectiveness. Coal and oil suppliers require motivation to actively promote their product, and initial stimulus may be provided by holding a workshop on the role of suppliers in promoting energy effectiveness and the benefits

to suppliers. Lessons from other countries should be included in the workshop. In addition, government should remove any barriers to the formation of organizations such as the Transvaal Coal Owners' Association.

Electricity and gas, the energy effective use of which can have additional benefits to the supplier, require separate attention under the subject of integrated resource planning (IRP). It is concluded that little effective regulation or profit incentive exist for utilities to apply IRP, and two options to address this problem are proposed. Either regulation is required to ensure that utilities adhere to the principles of IRP, or a government agency implements non-pricing demand-side management measures and utilities concern themselves only with supply. It is necessary that a working group be appointed to further investigate IRP in the South African context.

General pricing policy is beyond the scope of this study, but externality costs which could be significant in South Africa require attention. The main problem with externality costs is the complexity of calculation and the involvement of subjective considerations. Meetings with relevant organizations are required to decide on how externalities are to be dealt with.

A number of government programmes in other countries to promote energy effectiveness were investigated. Essential to any programme is a comprehensive energy database including energy use statistics, details of energy users, energy manufacturers, energy suppliers, consultants and auditors, details of energy effectiveness activities, data on energy equipment, and energy prices and tariffs. Such a database is required in South Africa.

Programmes can be broadly classified as information, financial incentives, regulations, and standards. Considering the financial constraints of public funding at present, it is unlikely that sufficient funds will be available for financial incentives. Even modest financial incentives would require R10-40 million/annum public funding. Only import duty relief on energy-efficient equipment should be given consideration at present. South Africa does not have the necessary skills available to industry to impose regulations such as appointing energy managers or supplying energy effectiveness plans. The only regulation which may be appropriate is the submission of energy use statistics. Standards for electric motors and boilers could yield large benefits, and it is suggested that voluntary standards be negotiated.

Information programmes are the cornerstone of a successful energy effectiveness strategy. Industrial organizations should be involved as much as possible. It is proposed that a general awareness campaign should begin by publishing the conclusions of this project, and journals and papers should be contacted about having features and adverts on energy effectiveness. In general, an industrial energy awareness campaign should be well targeted, eye-catching, concise, and make use of opinion leaders. Case studies need to be collected and published. Persons involved with energy effectiveness schemes should be encouraged to partake in general industrial seminars. A technical handbook, dealing specifically with South Africa, can be published and followed up later with a series of handbooks dealing with more specific subjects.

The inclusion of energy awareness in primary and secondary education would serve to ingrain energy awareness in our next generation. Key educationalists should be invited to a meeting to discuss a means for including energy effectiveness in curricula at undergraduate and postgraduate levels. Specialized training courses lasting from a few days to a month are essential and it is necessary to establish a coordinated ongoing training programme. Initially it may be necessary to develop skills in certain fields to provide adequately skilled trainers for the programme.

Provision of subsidized boiler tests has been found to yield quick results at little cost in other countries. A project to develop a methodology for such schemes for South Africa is proposed.

There are three levels of measures that companies can be made aware of: common industrial equipment and process changes, specific process changes, and implementation of new technologies. Each of these levels can be addressed by a different programme. Plant energy audits can identify improvements related to common industrial equipment and processes, sectorial audits can identify specific process changes, and demonstration projects can increase the penetration of new technologies. All three types of programmes are widely practised and pilot projects to develop appropriate methodologies for South Africa are proposed.

Electric motors are a specific area where large savings could be realized. Some issues such as selection and operation of electric motors will be addressed through general information programmes. Local production of more efficient electric motors is an area that requires further attention. Cogeneration is another area of potential that requires further attention.

The following is a summary of proposed initial projects and their total costs. They could be completed within two years.

National energy database	R 100 000
Energy management manual	R 300 000
Energy effectiveness training programme	R 300 000
Subsidized boiler testing scheme	R 100 000
Subsidized industrial energy auditing scheme	R 100 000
Sectorial energy audit scheme	R 100 000
Demonstration scheme	R 200 000
Total	R 1 200 000

Together with the estimated cost of the energy effectiveness group and research assistance, the total cost of the strategy to government over the next two years is R4,8 million.

The following are proposed medium-term projects and their annual costs.

Database	R 300 000
Awareness campaign	R 1 000 000
Training programme	R 400 000
Boiler testing scheme	R 500 000
Plant audit scheme	R 1 500 000
Sectorial audit scheme	R 900 000
Demonstration scheme	R 2 000 000
Total	R 6 600 000

In addition it is estimated that about R2 million/annum could be provided for research assistance (including cogeneration) in the medium-term. It is estimated that the energy effectiveness group will cost R800 000/annum, giving a total running cost for the industrial energy effectiveness strategy of R9,4 million/annnum in the medium term. It is estimated that the medium-term saving of this strategy, excluding savings from research and development and the stimulation of energy effectiveness activity by bodies such as energy suppliers, will be R483 million/annum.

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CHAPTER 1. INTRODUCTION

1.1 THE NEED FOR IMPROVED INDUSTRIAL ENERGY EFFECTIVENESS

In the past the South African government has involved itself with energy supply and has left energy effectiveness to market forces. However a careful examination of the situation in South Africa, supported by numerous past studies in other countries, has shown that there are a number of barriers in the market preventing the optimum allocation of resources. Through the two oil crises of the seventies, a growing awareness of the environmental effects of energy use, the need to reduce investment in additional energy supply, and a desire for increased economic growth, governments in most countries have identified these barriers and implemented strategies to remove them.

Many now feel that the South African government should formulate and implement a strategy to facilitate the more effective use of energy in South Africa, especially within the industrial sector. This sentiment has been fueled by an unmistakably large potential for the more effective use of energy in industry. In addition there has been concern about[1]:

- South Africa's high industrial energy intensity (energy use per unit GDP) which is at least double that of developed countries.
- South African industry spends about 11% of its GDP on energy compared with 5-9% for most other developed countries.
- South African industrial energy cost, expressed as a proportion of industrial GDP, rose 63% between 1970 and 1985.

Important benefits of improved industrial energy effectiveness are:

- Greater international competitiveness of South African goods through reduced manufacturing costs and compliance with international energy efficiency standards.
- Reduced local consumer costs.
- Reduced expenditure on energy, thus freeing finance for more pressing investment.
- Reduced environmental impact of energy use including atmospheric pollutants and greenhouse gases.
- Increased employment.

1.2 POTENTIAL SAVINGS THROUGH IMPROVED ENERGY EFFECTIVENESS

A previous report of this project[2] calculated potential energy cost savings to industry, and the results are summarized in Table 1.

Table 1. Annual cost of energy to industry in 2005 and 2015 (Rmillion, 1993 prices)

	2005		2015	
	LOW GROWTH	HIGH GROWTH	LOW GROWTH	HIGH GROWTH
Business-as-usual	12 998	15 445	13 676	20 752
Energy effective	11 846	13 651	11 830	17 479
Potential saving	1 152	1 794	1 847	3 273

In order for this potential to be realized, it is widely accepted that government, energy suppliers, energy equipment manufacturers/suppliers, educational organizations, energy contractors, consulting engineers, and consumers all have a role to play. However a number of barriers have prevented the necessary participation of each of these players in energy effectiveness. It is thus the role of government to provide the initial stimulus from which energy effectiveness activities can multiply.

1.3 SUMMARY OF THE APPROACH

The purpose of this report is to provide government with recommendations on an appropriate strategy to achieve more effective industrial energy use. Chapter Two investigates the role that could be played by each organization to promote energy effectiveness and assesses appropriate measures to ensure their participation. Chapter Three examines how pricing policy can be streamlined to facilitate greater

energy effectiveness. Chapter Four investigates integrated resource planning in South Africa. Chapter Five looks at appropriate elements of an industrial energy effectiveness programme for South Africa including a database, information, financial incentives, regulations, and standards. Chapter Six outlines a number of projects that could be initiated in the short term. Chapter Seven examines the different phases of the strategy, and estimates the manpower and financing required.

CHAPTER 2. INSTITUTIONAL MEASURES

A common feature of the effective use of energy in other countries is government commitment. The government is responsible for policy towards energy supply and demand and can empower implementing agencies with the legislative, administrative, and long-term funding authority needed to design and implement effective programmes.

2.1 POLICY AND PLANNING

An essential prerequisite for energy effectiveness is a strong central energy effectiveness group, the functions of which are typically to provide advice on energy effectiveness policy, setting of goals, co-ordination with other bodies and government departments, evaluation of programmes, and allocation of government funds. Essentially such a group is the watchdog of the consumer, especially smaller consumers. Under the current government structure only two full-time and one part-time persons, under the Chief Directorate: Energy, are wholly devoted to energy effectiveness. It is appropriate that the policy group is expanded from there with a number of persons devoted full time to energy effectiveness. In order that energy effectiveness is planned holistically, the energy effectiveness group should oversee all sectors of the energy-economy. It is therefore important that it co-operates with other government departments and bodies since energy effectiveness planning is intimately linked to economic planning, industrial development, urban planning, transport systems, and environmental issues.

2.2 IMPLEMENTATION

The policy group must decide on the role to be played in energy effectiveness by energy suppliers, equipment manufacturers/suppliers, energy service companies, government agencies, and consultants. Their appropriate roles differ from country to country, depending on the extent of regulation of energy suppliers, the degree of vertical integration in the energy sector, the existence of monopolies, competition in the market, customer attitudes to each potential player, and availability of technology and skilled manpower.

2.2.1 The role of energy suppliers

Energy suppliers can be valuable in promoting the effective use of energy because they usually have a wide knowledge of technology to improve energy efficiency, they are familiar with the needs of their customers, they have knowledge of customer consumption patterns, and they have the necessary marketing skills. Promoting energy effectiveness has two conflicting consequences for suppliers. It has the advantage of making their energy form more attractive, which will increase their customer base. However it has the disadvantage of requiring extra manpower and funding resources and will reduce energy consumption for a particular activity.

Sometimes it is feasible for electricity and gas utilities to promote energy effectiveness to reduce demand growth, but there is a lesser incentive for coal and oil suppliers to do so. ESKOM has embarked on making electricity more attractive, but this is being achieved through tariff negotiation and the development of new electricity technologies rather than providing a service to encourage the more effective use of electricity. Gascor does provide some service, but they supply a negligible fraction of the total energy used. Both coal and oil suppliers provide little service to their customers, and consequently promotion of energy carriers is heavily weighted towards electricity. However in order that energy users choose the most appropriate energy carrier for a particular purpose, it is preferable that all energy carriers are equally promoted. Two problems thus exist:

(1) Promotion of energy carriers is heavily weighted towards electricity.

(2) No energy supplier adequately promotes energy effectiveness.

Chapter Four covers electricity effectiveness under integrated resource planning. It is probable that if competition between energy carriers can be stimulated, then the promotion of energy effectiveness will become more attractive to all suppliers. The challenge is for government to stimulate oil and coal suppliers to promote their product. Initial stimulus may be provided by holding a workshop on the role of suppliers in promoting energy effectiveness and the benefits to suppliers. Lessons from other countries should be included in the workshop.

2.2.2 The role of equipment manufacturers/suppliers

Usually equipment manufacturers/suppliers are driven by competition in the market to provide more efficient equipment and customer services. In South Africa a survey has shown that equipment manufacturers/suppliers are relatively energy aware but are confused about how to implement greater energy effectiveness[3]. It is therefore

important that these issues be discussed with equipment manufacturers/suppliers with the possibility of reaching agreement with benefits for all parties, such as the establishment of voluntary equipment standards and joint R&D ventures.

2.2.3 The role of energy service companies

An outside company called an "energy service company" provides third-party financing whereby funds for energy-saving investment are provided in exchange for a share in the energy costs saved, usually around half of the savings. The energy service company will have the financial and engineering expertise to ensure a profitable energy-saving investment, as well as marketing skills.

The usual procedure to establish a third-party financing investment is[4]:

(1) The energy service company carries out a preliminary energy audit.
(2) A proposal is then made to the organization which outlines the programme for establishing and accomplishing predicted energy savings.
(3) A contract is negotiated and a baseline energy consumption pattern is agreed upon.
(4) The energy service company carries out a detailed energy audit, decides what is necessary, and installs all necessary equipment at its own cost.
(5) The organization and energy service company share in the financial benefit from energy savings made during the term of the contract, which is normally 2-10 years.
(6) Once the contract expires the organization might renew a revised contract, take ownership of the equipment, or have the option to buy the equipment.

Advantages of third-party financing to the organization are no investment funds are needed, the energy service company bears all the risk, no skilled manpower is required, and reduced energy costs. The challenge is for government to promote the establishment of energy service companies. Obstacles are the complexity of contracts, inadequacy of the legal and contracting framework, lack of knowledge about the technique, and high initial capital outlay. Energy service companies have been slow to take off in developing countries due to these obstacles. Government can encourage the development of such companies by providing a conducive tax environment and initial financial incentives.

Energy utilities, suppliers of monitoring equipment, and engineering consultants have established energy service companies in some countries. In South Africa it would appear that only ESKOM has the resources to implement third-party financing

of energy effectiveness projects. ESKOM has the financial means, close contact with energy users, and knowledge of energy efficiency technologies, but they may not always be objective in their advice and their advice would be restricted to electricity projects. In addition, with energy being of such a low priority in South Africa, it will be extremely difficult for energy service companies to persuade potential clients of the benefits of their service. Many South African companies are also loath to allow foreigners to scrutinize their plants. It thus appears that, as with many other developing countries, it may be premature for South Africa to establish energy service companies.

2.2.4 The role of a government agency

Whatever the role to be played by energy suppliers and equipment manufacturers/suppliers, they can only be expected to provide a service for their product. It is desirable that any imbalances in the market are smoothed and consumers are stimulated to use energy in the best interests of the country. This role is often fulfilled by the energy effectiveness group, discussed above, who may set up an energy agency to implement various facets of its strategy. An energy agency usually operates more effectively as a semi-autonomous body. A proposed organizational structure for such an agency is shown in Figure 1.

Tasks of such an agency usually include:

- Monitoring trends in energy efficiency
- Dissemination of information
- Promotion and assistance with demonstration projects
- Provision of quick energy audits or contacts for energy audits
- Training courses
- Helping regulatory authorities draft standards
- Serving as a focal point for energy efficiency information from NGOs and international assistance organizations
- Appraisal of financial assistance applications

A high level of technical and managerial skill is required to run such an agency. In many developing countries economic and technical assistance and training from international organizations have been invaluable in the establishment of an energy effectiveness agency. Appendix B has details of various organizations where assistance could be sought.

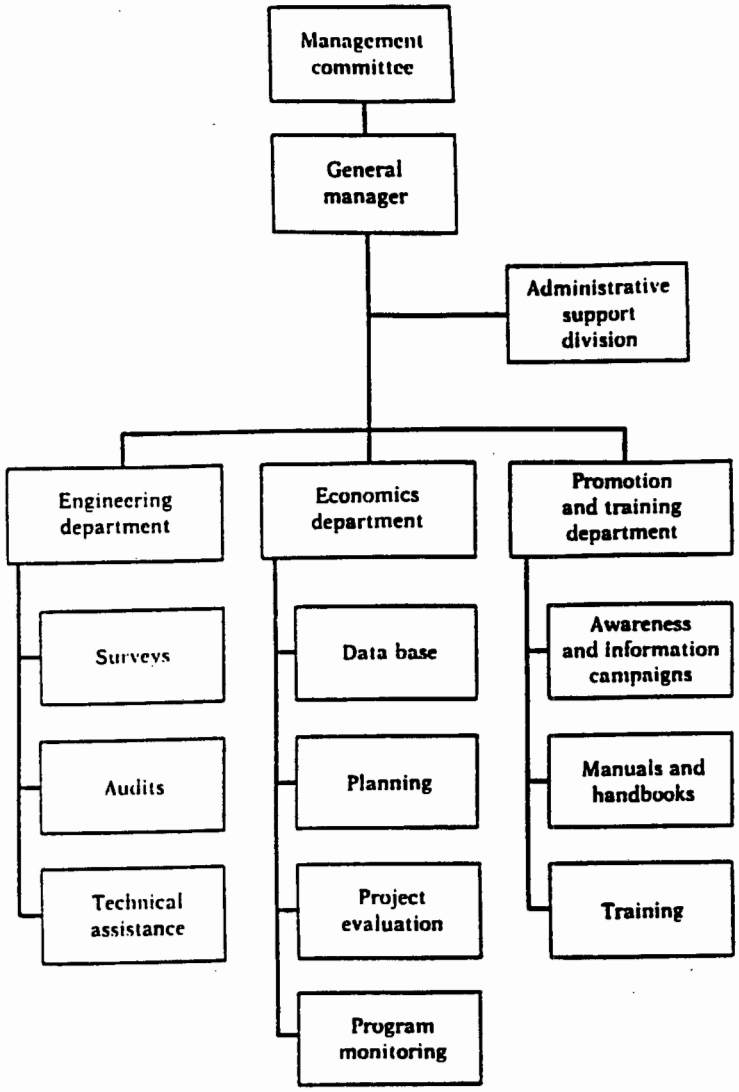

Figure 1. Proposed organizational structure of an energy effectiveness agency[5]

At present resources preclude the formation of such an agency in South Africa and consultants must be used for implementation of certain strategies. However, as the energy effectiveness programme gains momentum, so it may become desirable to set up such an agency as has been the case in many other countries. Its advantages are procedures can be standardized and all information and experience gained can be pooled.

2.3 MARKETING

The establishment of a competent marketing team is essential to the success of any programme. Such a team could either be set up within an energy agency or the services of an advertising/marketing agency could be contracted. In order to be able to target information effectively, it is necessary to have a database of consultants, research institutes, industry associations, equipment manufacturers, and companies.

2.4 FUNDING

In principle, an energy tax should provide for a more stable funding than from general taxes which are vulnerable to government policies and budgetary constraints. Some countries have recently levied taxes, in particular the CO_2 tax, to be devoted to energy efficiency. It would appear that an energy tax could be an effective means of raising funds for energy effectiveness in South Africa, as was practised a few years ago. A problem with such a tax is the resistance that may be met by industry which may undermine energy effectiveness initiatives. In view of these complexities, funding requires careful consideration and may require consultation with industrial representatives.

It is usually beneficial to have some kind of financial discipline from the energy effectiveness group to help focus on measures that yield the highest returns and will force working with energy suppliers, manufacturers, and energy consumers.

CHAPTER 3. PRICING

3.1 GENERAL PRICING POLICY

Most organizations support the policy that energy prices should reflect either the world market price where a world market exists, or the cost of maintaining supply of the fuel in the long term. In some instances it is difficult to assess long-term marginal costs, in which case it is necessary to compromise the above premise. Energy costs in South Africa are generally based on average costs. These issues are beyond the scope of this study.

3.2 EXTERNALITY COSTS

3.2.1 Definition of externality costs

Externality costs are costs of market transactions not reflected in prices. Externality costs associated with energy are environmental costs such as health-related costs, clean-up costs, increased corrosion costs, water pollution, etc. The most important environmental cost to have emerged in recent years is the possible effect of energy production on global warming and resulting international pressure on nations to reduce energy use. Other externality costs are danger of supply disruption and of price volatility, and the depletion of finite resources. It is accepted by most that energy externality costs can be significant, and in other countries they have been estimated to be about 10-50% of energy costs.

In order that prices reflect the real cost of energy supply, ideally all externality costs should be internalized in energy prices. However a major impediment to the internalization of externality costs is the problem of quantification of these costs which often requires subjective considerations. For instance, how does one calculate the cost of reduced visibility? Nevertheless developed countries are increasingly internalizing externality costs through stricter emission standards, pollution control regulations, taxes on emissions, or a direct tax on fuels. Where externality costs have not been internalized they are often still considered in energy planning.

3.2.2 Internalization of externality costs

There is no incentive for the energy supply industry to consider externalities, since by definition they are not incurred by the supplier, and thus will only be internalized through legislation. Common approaches to internalizing externalities include:

- Cost adders or discounts take the form of a simple percentage increase or discount applied to the cost of resources.
- Ranking and point systems are used by assigning points or rankings to various attributes associated with each resource option. The weight assigned to each attribute determines the importance of environmental impacts relative to other factors.
- Monetarization of costs. Most economists agree that in principle the best measure of externalities is **damage costs**, the costs of damages attributable to the use of a particular resource[6]. Determining damage costs is complex and often involves subjective considerations which are susceptible to criticism.

3.2.3 Options for South Africa

In South Africa the externality costs that are now being internalized in developed countries are not being considered. One cursory study[7] identified that far more information on the health and environmental effects of energy use is required. It would therefore be premature for South Africa to try and internalize externality costs at present, especially as even in developed countries controversy exists as to the calculation of externality costs. However energy policy-makers should be aware of trends in other countries and the impacts of energy use in South Africa. Future options to internalize externality costs are:

(1) Stricter legislation on emissions. This option is viable only if the costs of reducing emissions are clearly less than the benefits.

(2) Include externality costs into energy planning by using cost adders, discounts, or a ranking system. Cost adders and discounts can be derived from those commonly used in other countries. This will serve to internalize externalities where supply and demand options are considered, which is only for electricity. Fuel combustion in industry will not be included, which would give fuels an unfair advantage.

(3) Monetarize externality costs and internalize them by imposing an energy tax which can be used to pay for externalities. In order to do this it is necessary to determine more accurately the health and environmental effects of energy use, and then develop a methodology to calculate total externality costs and internalize them. Such costs will be different for each energy carrier and how it is used. It would be prudent to involve government, energy producers, energy suppliers, and consumers in this process.

CHAPTER 4. INTEGRATED RESOURCE PLANNING

4.1 INTRODUCTION

Essentially integrated resource planning (IRP) involves choosing the optimum mix of resources to satisfy the energy service requirements of customers. Government should apply the principles of integrated resource planning to the whole energy economy. Resources to be considered are those on the supply-side such as coal, oil, gas, renewables, and electricity, and those on the demand-side such as improved energy efficiency and fuel switching. This project is addressing demand because it is felt that government has placed too much emphasis on supply in the past.

Utilities, especially in the electricity and gas energy sectors, which require high capital investments for additional capacity, should also apply IRP. In their case the implementation of demand-side options is referred to as demand-side management (DSM). IRP is can be applied by utilities in two different ways:

(1) IRP optimizes, from a social point of view, all supply-side management and DSM options to satisfy an anticipated additional demand. Externality costs are either internalized in prices or they must be considered in planning in order that DSM is considered on an equal basis with supply. This approach requires centralized planning and a strong regulatory framework.

(2) IRP is perceived as a market-oriented approach. DSM constitutes a customer-oriented complement to supply-side management. Both demand and supply are optimized under competitive business criteria. Customer satisfaction is an important objective. This approach is driven by competition in the energy sector.

DSM options typically include the offering of appropriate tariffs, providing energy audits, promotional campaigns to increase awareness, provision of technical support and information, incentives, and direct installation. This chapter deals with the use of IRP by utilities, in particular ESKOM, since their DSM actions impact on the role to be played by other bodies in energy effectiveness.

4.2 BENEFITS OF INTEGRATED RESOURCE PLANNING

4.2.1 General benefits

Benefits of IRP to the customer are:

- increased profitability through reduced energy costs or improved productivity.

Benefits of IRP for the utilities are:

- better knowledge of demand and of the possibilities to influence it.
- avoidance of investment costs.
- greater customer satisfaction.
- better acceptance of electricity, power plants, grid connections, and the company by the public.
- alleviating increasing public concern regarding the siting and construction of energy facilities.
- reduced distribution costs

Benefits of IRP to the national economy are:

- reduction of energy expenditure, freeing more money to be spent elsewhere in the economy.
- optimal use of natural resources.
- appropriate consideration is given to the external costs of energy use.

4.2.2 Costs and savings in other countries

Table 2 shows some major DSM programmes that have been undertaken recently in other countries.

Table 2. Costs and savings of DSM programmes

Country	Period	Cost ($million)	Savings (GWh/annum)	(MW)	($million)[a]
Australia[22][b]	1992-2005	122	5100	1000	220
Brazil[20]	1986-1989	20	1785	465	950
India[21][c]	1992-2012	630	13236	3377	5910
Thailand[16]	1993-1997	189	1427	238	417

a Investment that would be required to supply the saved capacity.
b This is a medium scenario for the state of Victoria.
c For the state of Maharashtra.

4.3 STRUCTURAL FRAMEWORK FOR INTEGRATED RESOURCE PLANNING

DSM in the USA is applied mostly in the electricity industry, not in the gas industry. This is because the structure of the USA gas industry separates original gas supply, pipelines, and distribution to consumers. This makes DSM more difficult to organize than is the case when there is vertical integration from original supply to consumer in the electricity market. In the USA IRP has been achieved by active state-level regulation, enforced by the Public Utility Commissions.

In a market where supplier and distributor are separate, the supplier is only able to consider pricing as a DSM option since it has little knowledge of final customers. Distributors, in the absence of competition, have little incentive to promote the more efficient use of electricity since profits are strongly related to sales. In a vertically disaggregated competitive energy market, such as in the UK or Norway, DSM is sometimes feasible in order to foster customer satisfaction, but generally the disaggregated structure in these countries has stifled many DSM options (for this reason the Energy Saving Trust was established recently in the UK). In addition, for such a system the DSM measures chosen may be to optimize the needs of one level of the electricity industry but will not necessarily optimize national needs.

It can thus be concluded that when the supplier and distributor are separate it is difficult to provide incentives or introduce regulations to encourage DSM. Where there is little competition in the electricity sector, regulations are necessary to ensure that DSM measures are considered by utilities.

4.4 THE CURRENT SITUATION IN SOUTH AFRICA

There is little competition in the energy industry in South Africa and under the terms of reference of ESKOM some of the principles of IRP are implicit, but no explicit conditions are laid out. Consequently at present the only motive for IRP in ESKOM is social responsibility as IRP is not enforced by regulation or driven by a profit motive. ESKOM does claim to have initiated IRP through what they call Integrated Electricity Planning (IEP) and these initiatives are commendable. However IEP will only optimize resource allocation if a range of DSM options are considered in planning, which requires the allocation of sufficient funds to DSM research and the development of necessary skills. This cannot be left to social responsibility. In addition some factors beyond the control of ESKOM, such as the structure of the electricity distribution industry which affects the application of DSM, require attention.

Although enough excess electricity capacity exists for approximately the next ten years, the lead time required for a decision to be made for the building of a power station is about six to eight years, and the time required from planning of non-pricing DSM measures to noticeable results is typically five to ten years. A decision regarding the building of additional power stations will probably have to be made in the next few years. It is thus imperative that a framework for IRP is established soon in South Africa so that DSM measures can be considered as an alternative to supply.

The greatest barriers to successful IRP implementation in South Africa are lack of incentives or regulations to ensure IRP is practised, distortion of true electricity prices by distributors, lack of knowledge of the costs and energy savings possible for different DSM options, lack of knowledge about customer behaviour, the fragmented nature of the electricity distribution industry, and the lack of information on externality costs.

4.5 PROPOSED STRATEGIC PLAN FOR SOUTH AFRICA

4.5.1 The regulation option

Electricity utilities have advantages as promoters of DSM activities since they already have a relationship with many customers and they have the infrastructure including research, marketing, and technical experience. Their experience in managing sizable investments is an added advantage. For these reasons it is believed that ESKOM and the electricity distributors may be appropriate bodies to carry out DSM. The responsibility of DSM should be a consideration in the present restructuring of the electricity sector.

It appears that there will continue to be little competition in the electricity sector and thus the principles of IRP would have to be applied by a regulatory body. It would be the role of the regulatory board to ensure that IRP is carried out adequately by co-ordinating the activities of ESKOM and distributors. ESKOM would be required to submit to the regulatory body periodic plans of meeting future demand, and electricity suppliers would have to submit details of their activities. The board can then decide on the optimum allocation of resources and ensure that appropriate measures are taken by ESKOM and distributors. A comprehensive check list of DSM alternatives and a methodology for the evaluation of DSM options are also required. Such a list can be drawn up in collaboration with ESKOM, distributors, government, and overseas specialists.

4.5.2 The independent agency option

A problem with regulation is that a regulatory body will require highly knowledgeable members who are capable of performing the necessary calculations for IRP. At present few people in South Africa are adequately trained. In addition the separation of supplier and distributor in South Africa in many instances makes it difficult for utilities to implement DSM successfully. Another option would for an independent body, such as the government energy agency, to carry out DSM. Investment for DSM would be derived from a tax on electricity and the agency would ensure that only those DSM measures with a cost below that of the marginal cost of electricity would be supported. Suppliers and distributors would then concern themselves only with supply.

4.5.3 Short-term activities

Whatever the best option, initially it will be necessary to establish a working group to analyze and clarify the conception of IRP and DSM, examine how it should be applied to South Africa, examine the possibilities and limits to improve the situation, and decide upon an appropriate institutional structure to carry out DSM. Representatives should include the government, electricity distributors, ESKOM, and individuals with DSM experience. From this working group a master plan will follow, and it is envisaged that the stages of such a plan might resemble the following:

- Make any necessary amendments to the Electricity Act Regulations and appoint a regulatory body or a government agency.
- Enhance local expertise through training. Skills required will be management, engineering analysis, finance, marketing and customer service. It would be useful to invite to South Africa overseas persons of substantial experience to give talks and participate in workshops on DSM. In addition it may be useful to subsidize the training of one or more persons overseas (Appendix B).
- Continue to improve detailed end-use data by type of equipment and type of customer. This database is essential for planning. It would be beneficial if all available information was pooled at one load research centre.
- A check list of DSM measures can be compiled and updated continuously.
- A pilot project can then be planned and implemented to evaluate different DSM measures and marketing strategies. A formal framework for assessing DSM, designing programmes and strategies, and for their implementation can be drafted during the pilot project.

CHAPTER 5. MEASURES FOR GOVERNMENT TO PROMOTE ENERGY EFFECTIVENESS

5.1 INTRODUCTION

Possible measures for the government to promote improved industrial energy effectiveness is analyzed in this section. It is generally accepted that a mix of policies is best mainly because energy is consumed in so many different ways by so many different types of consumers. It is important that an assistance programme does not favour energy-intensive industries, otherwise the programme will facilitate structural adjustment towards energy-intensive industry. The most successful strategies to promote industrial energy effectiveness appear to be those that are integrated into the overall economic policy environment of the country concerned.

It is agreed by most that government subsidies are acceptable if they are clearly cost-effective for the economy. However whatever is provided for free is generally not appreciated and therefore only partial subsidies should be considered. It would appear that a maximum subsidy level of 50% is appropriate.

The overriding motive for improved industrial energy effectiveness in South Africa appears to be increased profitability[3], which can be accomplished through reduced operating costs, higher than average return on investment, improved product quality, improved production reliability, and improved public image. It is essential to focus on these issues when promoting energy effectiveness and not merely on saving energy. In addition most executives in South Africa believe that the user is responsible for energy effectiveness[3] and thus the government should give the impression of being a facilitator rather than regulator.

5.2 DATABASE

A comprehensive database is essential as a basic building block of a good energy effectiveness programme. It is necessary that such a database is regularly updated. A database should include the following:

- energy statistics for each major energy user.
- details of relevant equipment manufacturers, energy auditors or consultants, and energy suppliers.
- results of energy effectiveness activities.

- details of energy using equipment.
- energy prices and tariffs.

The database is essential for:

- Targeting information dissemination to consumers, equipment manufacturers/suppliers, and energy consultants. Information to be disseminated can include notification of workshops, seminars, or training courses; successful demonstration schemes and new technologies; sectorial energy guides; details about energy audits; financial assistance programmes; and the latest energy prices and tariffs with projections for the near future.
- Assessment of energy effectiveness potential and the consequent setting of practical goals.
- Planning of energy effectiveness measures including information, financial incentives, regulations, and standards.
- Monitoring the success of energy effectiveness measures.

Accurate energy use statistics are essential, and such statistics can be obtained from the Cooper database. Discussions should be held with Cooper to determine the problems with data collection and how they can be better addressed in order to improve the accuracy of statistics. Other databases of interest are the Bureau for Market Research electricity database and the Central Statistical Services address database. It is first necessary to decide on the information that will be collected, and then in conjunction with a programmer build the structure of a database. At present such a database could be maintained within the DMEA, but later it could be transferred to the energy effectiveness agency if established.

5.3 INFORMATION

5.3.1 Introduction

Provision of information can be used to complement other policy instruments and is invaluable in ensuring the success of other types of policy measures. Even company executives in South Africa, who generally would like as little government intervention as possible, believe that the government should provide information on energy effectiveness[3]. Information programmes are not designed to save energy directly and therefore their effectiveness cannot be measured. They should be ongoing as awareness is not static and needs to be reinforced periodically.

To make any programme successful the information on the programme and its mode of communication is crucial. This has lead to programmes becoming more group-specific. Target groups should include technicians, engineers, managers, and managing directors. Direct links should be established with companies and their representatives. An important medium for disseminating and gathering information is industrial associations such as the Association of Pulp, Paper, and Board Manufacturers of South Africa, the South African Cement Producers' Association, the South African Clay-brick Association, and the Chamber of Mines. Other institutions of interest are the Industrial Development Corporation and the South African Chamber of Business.

5.3.2 Creating awareness

Management is an important target group as it is responsible for the allocation of funds and skills to energy management. However management will usually read only what they perceive to be important. As a result less than a quarter of company executives could spontaneously recall an advertising campaign using a number of business/financial publications[3]. Generally it was felt that interest would be shown only if topics related to their own industry. Based on the conclusions of the advertising campaign, it would appear that an industrial energy awareness campaign should be well targeted, eye-catching, concise, and make use of opinion leaders. In addition an awareness campaign will have to be ongoing to have any real effect, and it must be stressed that energy management is about increasing profits not decreasing energy use or energy costs.

Opinion leaders are an important vehicle for information dissemination because of their perceived neutrality and objectivity, and they carry more credibility than government and energy supply companies[8]. An awareness campaign will be more effective for small and medium-sized plants since it is unlikely that large industries will take much notice as top management believes that energy is already adequately managed on their plants.

It is proposed that as a start to an awareness campaign a brief outline of the findings of this project be sent to various local papers and journals including Engineering News, Engineering Weekly, local mining journals, Financial Mail, and Finance Week. Case studies of successful energy effectiveness activities should be collected through seminars and liaison with energy consultants. These case studies can then be printed in prominent journals and newspapers. These publications could also be approached about having energy management as one of their annual features.

5.3.3 Energy journal

Energy efficiency centres have published their own journals, usually on a monthly or quarterly basis, to disseminate general information on energy efficiency. Information may include success stories, new energy technologies, energy efficiency assistance schemes currently offered, energy consultants, and energy management advice. It may however be that the market for such a journal is too small at present to justify the publication of such a journal in South Africa. It may be more viable in the future when there is more energy effectiveness activity taking place in South Africa.

5.3.4 Seminars

The annual Enerconomy seminar provides a useful forum for the exchange of information and helps foster awareness among participants, and is thus invaluable. However it does not reach those who are unaware of energy management potential. Organizing additional seminars specifically for energy effectiveness will be costly and attract only the energy-aware. A better option would be to incorporate energy effectiveness into more general seminars involving industry. This could be achieved by encouraging persons involved with successful energy effectiveness projects to participate in seminars. Prominent persons from companies with no energy effectiveness record could also be approached about presenting papers on energy effectiveness. This would have the dual effect of promoting energy effectiveness in that company and disseminating energy effectiveness information to others.

5.3.5 Technical handbooks

This can be a series of handbooks on energy management or a more general single handbook. Initially it would be less costly but still effective if a general manual on energy management is published for South Africa. This can include topics such as organizing energy management, boiler operation, steam systems, insulation, refrigeration, compressed air, power factor correction, load factor improvement, lighting, and maintenance schemes. Examples of costs and potential savings could be included, such as costs of steam or compressed air leaks, costs of insulation verses energy saved, costs of power factor correction verses electricity saved, etc. Important addresses of equipment manufacturers and consultants can also be included. At a later date a more comprehensive series of manuals could be published, perhaps to accompany training courses.

5.3.6 Advisory services

Regional advice centres or a central telephone advisory service, sometimes computer-assisted, are options. In order to be reputable they require highly skilled manpower which is probably too costly at present.

5.3.7 Education and training

Broadly there are three categories of educational activity that must be considered: schooling, academic degree and diploma level studies, and specialized training courses. Primary and secondary schooling should be where energy awareness is ingrained into our culture. Achievements in increasing awareness about recycling and water conservation are testimony to the importance of creating awareness from as early an age as possible. The mechanisms by which the promotion recycling and water conservation began in schooling should be investigated and appropriate steps taken in order for energy awareness to follow the same route.

Use will only be made of formal educational and training facilities if there is a demand for such skills. Promotion of energy awareness is therefore an essential prerequisite to the success of formal education and training initiatives. Academic education will provide engineering and management skills with enhanced energy awareness and expertise. Skilled energy consultants can be trained through post-graduate courses. Target educational institutions would include business schools and engineering departments at universities and technicons. Key educationalists should be invited to meetings to address education. This may also stimulate co-operation and information exchange between relevant educationalists.

Specialized short training courses are often recognized as being of prime importance to the development of improved energy effectiveness. They can vary in length from a few days to a month. Topics of importance include energy management, energy audits, power factor improvement, and combustion efficiency. These activities can be organized and promoted by government, although costs can be partially recovered through course fees. Courses can be conducted by equipment manufacturers, energy consultants or auditors, energy suppliers, and specialists in education. Periodically experts from other countries can be used to give talks or courses.

Often an association for energy managers is established to provide a forum for the exchange of information and to assist in the professionalization of the role of energy managers. Since there is no training programme for energy managers, it would be premature to set up such a body at present. If a certificate were to be provided on completion of a training course on energy management, then that person could automatically become a member of such an association.

Since organizing training courses may take some time and expertise, bursaries for specific courses of study abroad could be provided to bridge that gap, and also to provide the country with an up-to-date energy management know-how. Bursars may, on their return, be required to give talks and/or reports on what they learnt.

5.3.8 Boiler testing

Industrial boiler testing is a type of specialized audit that can be considered for subsidization. Measures to improve boiler efficiency are generally low-cost and thus boiler test recommendations are usually implemented. Such audits can be carried out by boiler suppliers. Boiler suppliers should be contacted and joint agreements secured. Information regarding the operation of boilers can be disseminated in this manner.

5.3.9 Plant energy audit

There are three levels of measures that companies can be made aware of: common industrial equipment and process changes, specific process changes, and implementation of new technologies. Each of these levels can be addressed by a different programme. Plant energy audits can identify those related to common industrial equipment and processes, sectorial audits can identify specific process changes, and demonstration projects can increase the penetration of new technologies.

Audits can be classified as quick audits requiring one to three days, and detailed audits requiring a number of days or weeks. Generally quick audits in other countries are at least part-subsidized by the government. Often the cost of a detailed audit is fully or partially reimbursed if it is followed by investment. The objectives of subsidized audits are:

- Increase awareness and provide industries with basic information of energy usage on their plants and areas where energy can be used more effectively with minimum cost.

- Motivate industries to conduct detailed audits.
- Collect energy use data and information on potential energy effectiveness improvements.
- Determine which audit recommendations were not implemented and the barriers to their implementation.

In general only a fraction of the opportunities identified by energy audits are implemented. The first to be implemented are no-cost or low-cost measures. In order to overcome this barrier two strategies have been employed:

- Only a portion of the audit subsidy is paid before the audit, with the other portion payable only after economically feasible projects have been implemented. It has been found in some countries that consumers are reluctant to advance the cost of an audit[9].
- The audits are supported with financial incentives. This strategy has been far more successful.

Subsidized industrial energy audits will be invaluable in South Africa as a means of informing managers of opportunities for improved energy effectiveness, and as a vehicle for the dissemination of general energy effectiveness information. Audits will be especially useful to small and medium-sized businesses which cannot afford to have in-house energy managers. It is suggested that 50% of the audit cost be subsidized. Because of the lack of energy awareness in South Africa, it is recommended that audits are well marketed to ensure the greatest possible penetration.

Two options are available: energy bus scheme or walk-through audits. The former scheme has the advantage of ensuring a more consistent audit methodology and immediate information can be supplied, while the latter does not require any initial investment costs and can be more flexible. If there is sufficient funding available it is recommended that the energy bus scheme be further investigated. A number of regional energy buses in industrial centres of the country could be established. Initially one could be established on a trail basis and the others then developed from the lessons learnt from the first. If insufficient funding is available for the energy bus scheme, then a national industrial energy auditing methodology for consultants

should be established. Such a methodology can be developed through a study of the options available and testing of these options with a number of plant audits. It would be useful to have an overseas person provide a training workshop on energy auditing for potential consultants in South Africa.

It is necessary to ensure that energy auditors are properly qualified, through training such as periodic workshops on energy auditing for consultants. It is also useful to compile a directory of independent auditors who have been recognized as being competent and, in the case of subsidized audits, will provide a directory of auditors whose work the government will subsidize.

Once audits have been performed it is imperative that they are followed up later with an investigation of measures that were implemented, benefits realized as a result of the audit, and reasons for certain measures not being implemented. This will be useful in establishing standards for the carrying out and presentation of audits, indicate the cost-effectiveness of subsidized audits, and will indicate whether an incentive scheme is necessary and, if so, whether it will help in designing such a scheme. It would be useful to publicize the results of audits to foster awareness.

5.3.10 Sectorial energy audits

Sectorial energy audits are common in many countries and can involve the compilation of energy consumption guidelines for a specific industrial sector and the provision of information on good practices in that sector with regard to energy effectiveness. Included is often an analysis of practices in other countries and their applicability locally. These studies also highlight energy-intensive and energy-wasteful areas, and areas where energy could be used more effectively. Literature surveys, plant energy audits, and general surveys need to be conducted. Access payments may also be required in order that information for case studies can be collected and published. The scheme requires comprehensive marketing which may include dissemination of sectorial reports, workshops, meetings, and plant visits. This type of audit requires a knowledgeable consultant.

Once those industrial sectors with most potential for improved energy effectiveness have been identified, the government could sponsor sectorial energy audits in those sectors.

5.3.11 Demonstration schemes

Demonstration schemes increase the market penetration of new technologies by marketing the success of a project. They involve an agreement with a company whereby in return for a grant the company will allow their energy consumption to be analyzed before and after implementation of the technology, and if successful the technology can be marketed. Clearly demonstration projects need to be comprehensively assessed before acceptance, but it is important that bureaucratic procedures are as short and efficient as possible. A major decision for such a scheme is the level of the grant to be given to the company. It is important that the grant amount does not detract from the commitment of the company to the new technology. Marketing is the key to the success of a demonstration project.

The South African government is unlikely to have the resources to carry out a comprehensive demonstration scheme although the returns can be large. It is therefore recommended that such a scheme be initiated on an informal basis in order that experience can be gained. The problem is persuading companies to apply for demonstration projects. Some kind of pilot project is required to develop a methodology. An energy consultant should be used to measure energy use before and after implementation of the scheme, and if the project is successful, it should be marketed to a target audience. The Energy Technology Support Unit in the UK has implemented a successful demonstration programme, and it may be useful to send someone from South Africa to work there for a short period (details in Appendix B).

5.4 FINANCIAL INCENTIVES

5.4.1 Introduction

In general, assessments of financial incentive in other countries' schemes have indicated benefit-cost ratios of typically 3 to 5. Financial incentives should be considered for investments in energy-efficient equipment that is substantially more expensive than their less efficient counterparts, but is ultimately cheaper based on life-cycle costing. Financial incentives should also be considered for manufacturers to encourage the development of energy-efficient equipment.

Financial incentives do have a catalytic effect on drawing attention to opportunities and initiating more detailed investigation. In order to make a project viable, government assistance must usually be considerable, consequently the objective of financial incentives is catalytic rather than to make opportunities cost-effective.

Financial incentives are susceptible to 'free riders', parties who would have invested in the project without the scheme, and the extent of this effect should be minimized by careful programme planning.

Disincentives have usually been applied only in times of severe energy shortages and are not applicable to South Africa at present.

5.4.2 Grants

Grants have a complicated application and approval process requiring considerable administrative work. Often these bureaucratic procedures have resulted in the reluctance of companies to participate. They have been phased out of many programmes or have become more group-specific. In order to calculate approximate costs of grants, it is assumed that each year 2% of all industrial users, who total about 100 000, use the scheme for one energy-effective system costing an average of R50 000. The total cost of those schemes is thus R100 million/annum. If grants were to be 20% of the total cost of energy-effective schemes, then the subsidy would be R20 million/annum.

5.4.3 Tax incentives

Tax credits are most widely used. They are usually fitted into the general array of tax incentives available to companies. Tax incentives are offered in two forms: either the investment is deducted from taxable income, or part of the investment is deducted from the income tax[9]. A few developing countries have implemented preferential tax policies whereby imported energy-efficient equipment is exempt from import duties, and energy-efficient products are exempt from sales tax[10]. Assuming that R100 million/annum investment is tax-deductible, the government subsidy would be R40 million/annum.

5.4.4 Loans

Administrative work for loans is often even more complex than for grants. Two utilities in the USA found that 90% of customers preferred grants to loans[10]. If R100 million/annum was to be provided at 10% below the prime rate, the subsidy would in effect be R10 million/annum.

5.4.5 Rebates

The most successful rebate schemes combine simple programme procedures, extensive marketing, and free technical assistance[10]. Typically, rebates cover 30-50% of the cost of a measure. For R100 million/annum total investment rebates would amount to R30-R50 million/annum.

5.4.6 Direct installation

Customers often lack the time or expertise to implement measures on their own, even if financial assistance is offered. Direct installation programmmes minimize this barrier by providing comprehensive installation services. Direct installation schemes are often combined with subsidized audits and financial assistance. Experience in the USA has shown that direct installation results in high participation rates and corresponding energy savings, but the cost per unit of energy saved is more than most other types of programmes[10].

5.4.7 Import duty relief

Often energy-efficient equipment is not available in South Africa because the market for such articles is perceived to be too small. Import duties are charged on such equipment, rendering them unaffordable. If import duty relief was provided on energy-efficient equipment, entrepreneurs may then import energy-efficient equipment and market it effectively, thus increasing the demand for such equipment. Local production may then be stimulated.

5.4.8 Conclusion on financial incentives

Under the current tight government budget it is unlikely that financial incentives, which require substantial government investment (of the order of R10-40 million/annum), will be supported. It is more important to devote the limited available funding to an information programme and when more information is

available to assess more accurately the need for and benefits of financial incentives, then they can be more strongly motivated for. Import duty relief is an exception since some potential energy-efficient imports are being stifled by import duties. Import duty relief will not reduce income from taxes.

5.5 REGULATIONS

Regulations include appointment of energy managers, development of plans for new plants, reporting of energy use, periodic plant energy audits, and maintenance and checking of boilers. Generally most regulations will be effective only if appropriate energy services and skills are present, which is not the case in South Africa. In addition it is perhaps better that industry perceives authorities to be supportive rather than coercive. At present the only regulation which warrants investigation is that required to obtain all available statistics on industrial energy use.

5.6 STANDARDS

The large variety of technologies and costly measures of verification often make industrial standards unpractical. Industrial equipment that is more easily classified for efficiency standards are boilers, and electric motors. A common approach in Europe is to establish agreements with manufacturers and work with voluntary standards. Voluntary standards are often preferable because co-operation and negotiation yield better results than a unilateral system, they are more flexible, and they may be more respected by the manufacturer[9].

5.7 RESEARCH AND DEVELOPMENT

The NEC and DMEA have been successful in targeting a small R&D budget at relevant research. However the results of this research need to be more effectively distributed and marketed. Researchers should also be encouraged to publish their work. Research should be expanded to consumer-behaviour research important for marketing. Joint R&D ventures between government and industry are useful to ensure technology transfer.

It would appear from the large disparities between current energy intensities and potential energy intensities using current technology that the constraint to improved energy effectiveness in the short term is not primarily technological. Pursuit of additional opportunities through basic research and development is however important in the long term. Basic research should be directed towards industries where South Africa is at the forefront of technology and not duplicated in areas where research is being carried out in other countries. More attention should be given to applied research, especially in those industries which are too fragmented to carry out their own research. In order to ensure successful technology transfer, R&D assistance should take the form of joint ventures, and successful research should be guided towards demonstration.

Equipment manufacturers, such as electric motor manufacturers, should also be considered for research assistance.

5.8 SOME SPECIFIC AREAS

5.8.1 Electric motors

Electric motors are the single largest energy cost in industry in South Africa, with approximately R5 billion/annum spent on electricity for electric motors. A detailed report outlining a strategy to improve the effective use of electric motors has already been compiled[11] and it is suggested that its recommendations be noted. The followings suggestions, mostly derived from the above study, indicate how to improve the effective use of electric motors.

Selection of electric motors: One of the main reasons for efficiencies of motors being low is that they have initially been incorrectly selected, either oversized or a low efficiency motor selected. Suppliers, who are well aware of this problem, should be consulted in this regard. Provision of technical manuals and training courses can help alleviate this problem.

Variable speed drives: Recently costs of variable speed drives for AC motors have decreased and in many cases they are now cost effective. Technical manuals, training courses, and energy audits can facilitate the penetration of variable speed drives.

Electric motor standards: The internal efficiency of South African motors is still markedly lower than the energy-efficient standards used in developed countries[11]. Manufacturers have already indicated a willingness to adopt standards, and it may be possible to reach an agreement with manufacturers whereby voluntary standards are set in return for financial assistance. Funds could be provided for further local research into improving motor efficiency and improved computer design tools. The government could also help create a joint development between manufacturers and ISCOR to develop a better electrical motor steel to minimize losses. Energy-efficient motors will only be bought if there is awareness of their potential benefits and thus their success hinges on the promotion of energy awareness and the marketing of these motors.

Subsidization of motor buyers: This option should be considered only when energy effectiveness is of a higher profile in government and more is known of the potential benefits. It would encourage the development and manufacture of energy-efficient motors.

5.8.2 Cogeneration

Cogeneration can either provide power for internal use and/or for export to the grid. Advantages of both types of cogeneration are:

(1) Greater efficiency of utilization of resources because of the greater overall efficiencies of cogeneration.

(2) Capital commitments are reduced and, if the cogeneration is financed by domestic sources, then the amount of foreign exchange will be less.

(3) The possible substitution of coal with a lower grade fuel, such as off-gas, bagasse or wood.

In order for cogeneration of power for internal use to be viable for a company, it is necessary that electricity can be produced at a cheaper rate than the cost of purchased electricity, and the rate of return on capital investment is adequate. Even if cogeneration does not satisfy a company's economic requirements, it may still be in the national interest because of the advantages indicated above. As long as ESKOM can purchase export electricity from local cogenerators at a cheaper rate than ESKOM can generate electricity, it is of national interest that ESKOM does so. However barriers of cogeneration for export are:

(1) The current surplus capacity of ESKOM which is expected to last until early into the next decade. At that stage ESKOM may have the option of importing electricity from external sources such as hydro-power from other countries.

(2) The return on capital investment in private industry is higher than that of the electricity supply industry.

(3) The electricity supply industry is exempt from taxation.

It is thus evident that cogeneration possibilities that are not economically viable for industry may still be beneficial to the nation. Suggestions for South Africa to rectify this imbalance are:

(1) Support of cogeneration feasibility studies. Some industries have been identified with cogeneration potential in a comprehensive report on cogeneration[12] and they can be contacted about the possibility of joint feasibility studies.

(2) Provision of financial incentives such as tax concessions on cogeneration capital expenditure.

(3) A clear policy of the conditions for the sale of cogenerated power to the national grid.

6. PROPOSED PROJECTS IN THE SHORT TERM

6.1 NATIONAL ENERGY DATABASE

Final output:
A national energy database which can be continuously updated. Statistics should include energy use statistics of all energy consumers, relevant contacts in all companies, details of auditors, consultants, equipment suppliers, and energy suppliers, results of energy effectiveness activities, details of energy-efficient equipment, and energy prices and tariffs.

Potential benefits:
Information dissemination can be comprehensive and well targeted. The success of energy effectiveness activities can be assessed and new activities planned. Information will be available for assessing potential and establishing targets. The cost effectiveness of government expenditure can be assessed.

Methodological steps:
- The DMEA must clearly define the information it requires.
- The structure of a database should be built in conjunction with a programmer.

Resources for the project:
The assistance of an energy consultant may be required for a short period of time to plan the content of the database. A programmer will be required for about a month to build the database. Project cost is estimated at R100 000.

Resources to maintain the database:
Someone with economic/engineering skills, spending about half their working time, will be required to update the database. One contractor is required to collect energy use statistics (the Cooper database). Total cost is estimated at R250 000/annum.

6.2 TECHNICAL MANUAL ON ENERGY MANAGEMENT

Final output:
A technical manual on energy management including organizing energy management, boiler operation, steam systems, insulation, refrigeration, compressed air, power factor correction, load factor improvement, lighting, and maintenance

schemes. The manual must be relevant to South Africa in terms of costs and availability of various energy forms.

Potential benefits:
The manual will increase awareness and improve the energy effectiveness knowledge of industrial personnel.

Methodological steps:
- Employ a consultant to write an outline for the manual.
- Have the outline evaluated by a number of knowledgeable people.
- Once the outline has been finalized the consultant can proceed to write the manual.
- Have the draft manual evaluated.
- Publish the manual.
- Through the database contact relevant personnel about buying such a manual at production cost. Advertise the manual in journals.

Resources for the project:
The manual will require about three man-months to write. Assuming 20 000 manuals are published at R30 per manual (total cost), and half these costs are recovered through sales, the project will require R300 000.

6.3 TRAINING PROGRAMME

Final output:
A methodology for a training programme and skilled training instructors.

Potential benefits:
Greater knowledge of how to implement energy effectiveness by managers, engineers, and technicians.

Methodological steps:
- Conduct a literature survey of how training courses are offered and the types of courses provided in other countries, and obtain samples of course material.
- Investigate the skills available in South Africa and determine whether additional training is necessary in order to have competent training instructors.

- Develop a methodology for a training programme including where the training will be held, the degree of subsidization, how often courses will be offered, and how the training programme will be marketed.
- Send one or more persons on training courses in other countries if necessary, or contact international technical aid associations about developing the necessary skills locally.

Resources for the project:
The literature survey and development of a methodology should take about six man-months, requiring about R80 000. It is anticipated that further skills development will also be required, which will cost of the order of R220 000 spread over two years.

Resources to implement the programme:
Training costs and course material can be partially recovered through fees. It is estimated that the organizational and marketing costs for a training programme may be of the order of R400 000/annum.

6.4 BOILER TESTING SCHEME

Final output:
Current boiler efficiencies in South Africa and potential improvement. An appropriate methodology for a national boiler testing scheme.

Potential benefits:
It has been claimed that boiler efficiencies can be improved by about 3% on average through optimization of air ratios[21], and it is estimated that a further 2% improvement can be realized through additional measures (for many boilers, especially smaller boilers, the potential is in excess of 20%). It is estimated that two-thirds of the potential savings will be implemented in a sustainable manner and that most of the potential savings will have been realized in three years. Assuming boilers consume 250 PJ/year, the saving three years after implementation could be R33 million/year (average fuel cost 0,4c/MJ). For a similar programme in Pakistan an average potential improvement of 10% in boiler/furnace efficiencies was identified[16].

Methodological steps:
- Examine the potential for energy efficiency improvement in South African boilers and propose the level of government subsidy.

- Examine who is best skilled to conduct the boiler tests and hold meetings with these persons to decide on how the scheme can be implemented and marketed.

Resources for the project:
The examination of potential will require about three man-months. A further two months may be required to investigate how the scheme could be implemented. Project cost is estimated at R100 000.

Resources to implement the scheme:
One full-time boiler auditor will be required for each metropolitan centre of the country. Other costs will be administration and marketing. Assuming the scheme to be 50% subsidized, the government contribution, including marketing and administration costs, is estimated at R500 000/annum. The cost-benefit ratio would then be 1:22. This estimate is conservative when compared to ratio of 1:45 for a similar Irish scheme[13].

6.5 SUBSIDIZED ENERGY AUDIT SCHEME

Final output:
A methodology for a subsidized national energy audit scheme that can be immediately implemented.

Potential benefits:
Subsidized energy audits will generally only identify savings for common industrial end-uses such as motors, furnaces, boilers, steam systems, and electricity systems. Total existing potential of common energy end-uses was estimated at 76-150 PJ. It is conservatively estimated that a modest energy audit scheme in South Africa will identify 20 PJ after five years of operation. An analysis of energy audit programmes in 11 countries found that 56% of recommended measures were implemented[10]. The cost of energy saved through an audit scheme operating for five years is thus R146 million/annum (average cost of energy 1,3c/MJ).

Methodological steps:
- Literature survey of methodologies for subsidized energy audit schemes, and identification of one or more potential methodologies for South Africa.
- Testing and evaluation of one or more methodologies in South Africa.

- Recommendations on a methodology for a subsidized audit scheme for South Africa and evaluation by a steering committee.

Resources for the project:
The literature survey and identification of possible schemes should take three man-months. The testing, final recommendations, and final evaluation should take a further three man-months. Estimated project cost is R100 000.

Resources to implement the scheme:
It is estimated that two man-years per year of auditing will be required for each of the five metropolitan areas of the country. Either two full-time auditors can be used for each area or auditors can be drawn from a panel. In addition administration and marketing will be required. Assuming quick audits are 50% subsidized, government expenditure will be about R1,5 million/annum. This gives a cost-benefit ratio of 1:20. This is conservative compared to Australia where the cost-benefit ratio on initial evaluations has been estimated at 1:45[14].

6.6 SECTORIAL ENERGY AUDIT SCHEME

Final output:
A methodology for a sectorial energy audit scheme that can be immediately implemented.

Potential benefits:
A sectorial energy audit scheme will mostly identify specific process changes that can improve energy effectiveness. It is estimated that around 5% of industrial energy use could be cost-effectively saved through improved process changes, which is about 45 PJ. Assuming that a modest sectorial audit scheme would identify 10 PJ after five years' operation and half of this saving is implemented, the saving would be R65 million/year (average cost of energy 1,3c/MJ).

Methodological steps:
- Literature survey of methodologies for sectorial energy audit schemes and identification of one or more methodologies for South Africa.
- Testing and evaluation of one or more methodologies in one industrial sector of South Africa.
- Recommendations for a methodology for a sectorial energy audit scheme and evaluation by a steering committee.

Resources for the project:
The literature survey and identification of possible schemes should take three man-months. The testing, final recommendations, and final evaluation should take a further three man-months. The project cost is estimated at R100 000.

Resources to implement the scheme:
Sectorial surveys may require the equivalent of two full-time researchers. Marketing costs may be extensive. Total costs are estimated at R900 000/annum.

6.7 DEMONSTRATION SCHEME

Final output:
A methodology for a demonstration scheme including the marketing of the scheme, criteria for acceptance, auditing of projects, and marketing of the results.

Potential benefits:
A demonstration scheme will facilitate the market penetration of new energy-effective technologies. It is difficult to gauge the potential savings of such a scheme, especially as in South Africa it could not be as comprehensive as in Europe. Assuming a cost-benefit ratio of 1:10,4 as in Britain[24], and an investment of R2 million/year in the medium term (compared to R26 million/annum in Britain), savings will be an additional R21 million/annum. Cumulative savings after 5 years would be R105 million/annum. At an average energy cost of 1,3c/MJ the cumulative savings would be 8,1 PJ.

Methodological steps:
- Literature survey of methodologies for a demonstration scheme and identification of one or more methodologies for South Africa.
- It is necessary that an appropriate new technology be found that has a good chance of being successful. Such a technology could be found by examination of successful schemes in other countries and a check that such a technology appears to be feasible for South Africa. Alternatively the project should only be initiated when a potential demonstration scheme has been identified such as through the sectorial audit scheme. Testing and evaluation of one or more methodologies can then commence.
- Recommendations for a methodology for a demonstration scheme and evaluation by a steering committee.

Resources for the project:
The literature survey should require three man-months. Assuming a demonstration scheme has been identified, the testing and evaluation can take anything from three months to a year depending on the proposed methodology and the type of scheme to be demonstrated. Project cost is estimated at R200 000.

Resources to implement the scheme:
It was assumed that R2 million/annum would be set aside for a demonstration scheme.

6.8 ELECTRIC MOTORS

Final output:
Improved efficiency of locally produced electric motors.

Potential benefits:
In 1987 South African producers manufactured 400 000 electric motors valued at R158 million with a total rating of 1,4 GW[11]. Assuming the motors are run at an average of 50% capacity, the energy used by new electric motors each year is 6132 GWh. If average motor efficiency of new motors can be improved by 2%, then 61 GWh/year can be saved, and after five years cumulative savings would be 615 GWh/year (2,2 PJ). Electricity savings would be R74 million/annum after five years of producing more efficient motors (average electricity cost 12c/kWh). The benefits depend largely on increasing energy awareness among those involved with motor selection.

Methodological steps:
- Examine how the efficiency of South African motors compares with overseas standards and propose projects that can be immediately implemented.
- One area of research that can be jointly funded by government, ISCOR, motor manufacturers, and perhaps ESKOM is improving the electrical properties of steel for motors to minimize losses.
- Another area of assistance is the tooling and computer design of energy-efficient motors.

Resources for the project:
In 1988 it was estimated that a similar project would cost in the order of R0,25-1,0 million[11]. With inflation costs will have doubled approximately to R0,5-2 million.

CHAPTER 7. THE PROPOSED STRATEGIC PLAN

7.1 PHASES OF THE STRATEGY

7.1.1 Initial phase

This phase can be implemented immediately and completed within six months.

(1) Publicize the conclusions of this project as far as possible to begin increasing energy awareness.
(2) Write a proposal motivating for greater government commitment to energy effectiveness. Include a declaration of the conclusions of the workshops and justify the establishment of an energy effectiveness group with adequate political power.
(3) Examine possibilities for technical and economic assistance and training from organizations overseas to establish and run an energy effectiveness programme.

7.1.2 Development phase

During this phase the energy effectiveness group can be established. The phase is mostly concerned with getting people around the table to discuss relevant issues and initiating a number of pilot projects necessary for the implementation of the energy effectiveness strategy. Further objectives can be established following meetings and pilot project proposals.

(1) Examine the role to be played by various groups and organizations in implementing the strategy, and decide on how each of them can become involved.
(2) Hold meetings with energy producers, electricity suppliers, and other government departments to decide whether externality costs warrant further investigation, and if so how these costs should be internalized and what information is necessary to try and internalize them.
(3) Have a meeting or workshop with energy suppliers on the role they can play in promoting energy effectiveness and the benefits they can derive.

(4) Arrange with ESKOM, electricity distributors, and energy consultants to establish a working group to investigate how IRP can best be applied in South Africa.

(5) Examine the inclusion of energy awareness in primary and secondary schooling.

(6) Meet with educationists to discuss the inclusion of energy effectiveness in management and engineering curricula.

(7) Examine the need for regulation to facilitate the collection of energy statistics.

(8) Meet with manufacturers of energy equipment to establish voluntary standards and discuss assistance in achieving these standards.

(9) Establish a clear policy on cogeneration and approach potential cogenerators about joint feasibility studies.

(10) Initiate a number of projects necessary for the implementation of the strategy. All projects can be completed within two years.

- Establishment of a national energy database.
- Publication of an energy management manual for industry in South Africa.
- Development of an energy effectiveness training programme.
- Development of a subsidized national boiler testing scheme.
- Development of a subsidized national industrial energy auditing scheme.
- Development of a sectorial energy audit scheme.
- Development of a national industrial demonstration scheme.
- Improvement of the efficiencies of locally produced electric motors.

7.1.3 Continuous phase

As each of the above initial projects is completed so implementation of that programme can begin. Figure 2 shows conceptually how the overall strategy can be implemented in order that it is continuously being optimized. In addition it is imperative that realistic targets are set based on a bottom-up analysis.

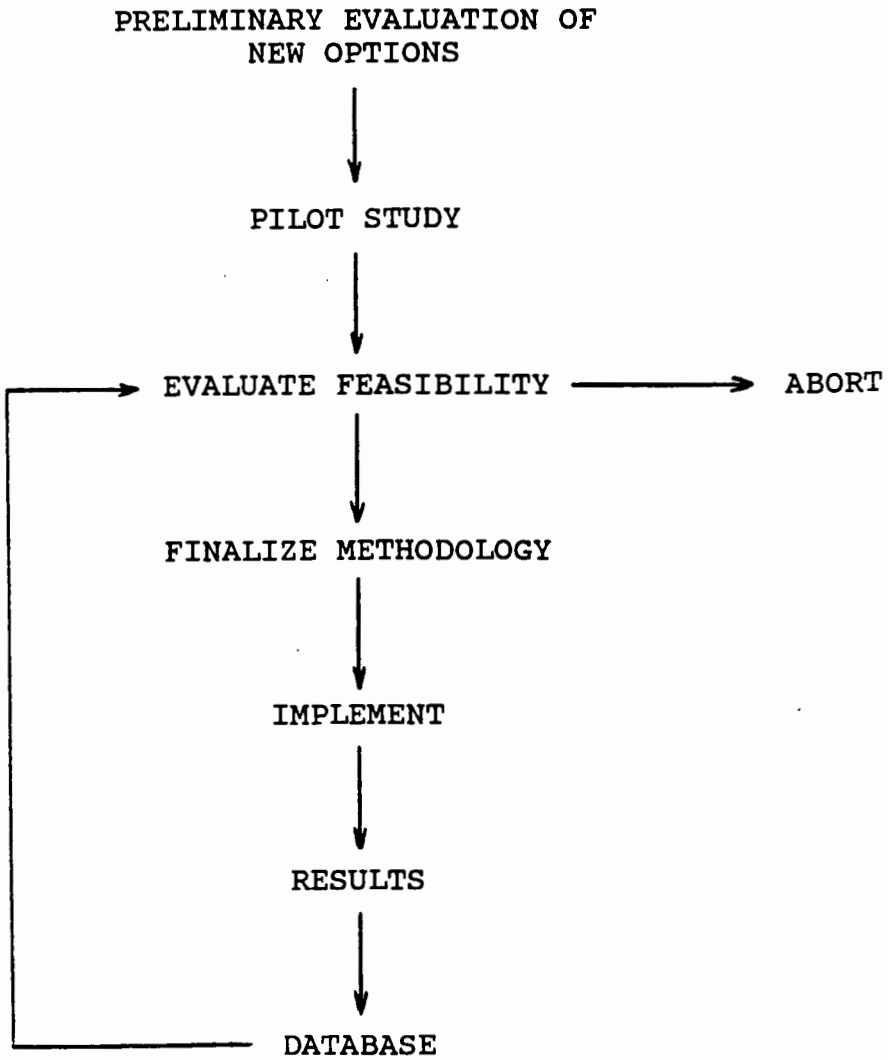

Figure 2. Conceptual running of an energy effectiveness programme

7.2 TARGETS OF THE STRATEGY

A previous report of this project[2] identified realistic targets for energy saving for low and high economic growth scenarios if a comprehensive programme began in 1995. The results are shown in Table 3.

Table 3. Potential energy reduction, demand reduction, and cost savings if a comprehensive industrial energy effectiveness programme was implemented from 1995

	2005		2015	
	LOW GROWTH	HIGH GROWTH	LOW GROWTH	HIGH GROWTH
Energy reduction (PJ/annum)	73	121	122	235
Demand reduction (MW/annum)	1559	2255	2445	3913
Annual saving (Rmillion/annum)	1152	1794	1847	3273

It is unlikely that the funding necessary for a programme to achieve the above savings will be available and consequently the strategic plan proposed in this report has been designed with the financial constraints kept in mind. With the lack of comprehensive information available at present and little knowledge of the level of government commitment in the future, it would be prudent to set only short and medium-term goals and update these goals and set longer term goals as more information becomes available. For some measures, such as an awareness campaign or education and training, it is impossible to quantify the benefits although these measures are essential for improved energy effectiveness and the success of other measures. The challenge is to be able to create an evaluation procedure that will be able to quantify the benefits of other measures such as energy audits and demonstration projects. The energy database will be essential for this purpose.

In the short term (the next two years) during the arrangement of institutional issues and the commencement of initial projects, energy savings will be minimal. Provisional goals for the medium term (the next five to ten years) for the proposed projects whose benefits are possible to quantify are given in Table 4. It is assumed that awareness, education, and training will be sufficient for opportunities to be implemented and thus their benefits are indirectly included. For cogeneration it is assumed that electricity is produced by ESKOM with an efficiency of 35% and by cogeneration with an efficiency of 75%. Potential cogeneration at present was estimated at 1471 MW[11] which is an annual electricity generation of 32 PJ (0,7 load factor). The saving in primary energy (mainly coal) is thus 48 PJ/annum. Through support for feasibility studies and other small incentives, at a cost of R0,5 million/annum, it is estimated that in five years half of this potential could be realized.

Table 4. Target energy savings five years after the implementation of the proposed projects, and estimated cumulative government investment

Project	Annual energy reduction (PJ)	Annual saving (Rmillion)	Cumulative government investment (Rmillion)
Boiler tests	8,3	33	1,5
Energy audits	11,2	146	7,5
Sectorial audits	5,0	65	4,5
Demonstration projects	8,1	105	10,0
Cogeneration	N/A	60	2,5
Efficient motors	2,2	74	2,0
Total	34,8	483	28

Excluding any indirect savings from R&D financial assistance and the stimulation of energy effectiveness promotion by various organizations such as energy suppliers, target savings of the proposed strategy in the medium term are R483 million/annum.

7.3 MANPOWER AND COSTS

7.3.1 Short-term costs

The costs of the initial projects proposed, which can be completed within two years, are summarized below.

National energy database	R 100 000
Energy management manual	R 300 000
Energy effectiveness training programme	R 300 000
Subsidized boiler testing scheme	R 100 000
Subsidized industrial energy auditing scheme	R 100 000
Sectorial energy audit scheme	R 100 000
Demonstration scheme	R 200 000
Total	R 1 200 000

The energy effectiveness group should oversee all sectors of the economy, but only the manpower requirements for the industrial sector are summarized below.

Task	**Full-time Manpower**	**Qualification**
Management	1	Management
Administration	1	Secretarial
Planning and evaluation	3	Economic/Engineering

Salaries and overheads of the energy effectiveness group will be about R800 000/annum. It is unlikely that financial incentives will be provided in the short term, but it is essential that well targeted research assistance continues. R2 million could be provided for research over the next two years. This includes basic, applied, customer behaviour, and market research. In the medium term this assistance can be increased as more areas of vital research are identified.

Total costs over the next two years are summarized below:

	Short term costs (Rmillion)
Energy effectiveness group	1,6
Initial projects	1,2
Research assistance	2,0
Total	4,8

7.3.2 Medium-term costs

Whether the programme is implemented by an agency and/or by consultants, resource requirements will be similar. South Africa can be divided into five metropolitan areas and therefore five regional agencies or panels of implementing consultants will be required.

Although it would be cost-effective to increase substantially investment in energy effectiveness, it is unlikely that the energy effectiveness budget could be increased significantly in the near future. It is first necessary to set up an appropriate framework for energy effectiveness and then demonstrate the cost-effectiveness of some initial measures, after which additional investment can be sought. The costs presented below are those necessary in the medium term in order to implement the projects proposed.

PROJECT	COST (Rand/annum)	
Database		**300 000**
Two engineers	200 000	
Administration	100 000	
Awareness campaign		**1 000 000**
Administration	200 000	
Marketing cost	800 000	
Training programme		**400 000**
Administration	200 000	
Marketing	200 000	

Boiler testing scheme (50% subsidy)		**500 000**
Auditors	700 000	
Administration	150 000	
Marketing	150 000	
Plant audit scheme (50% subsidy)		**1 500 000**
Auditors	1 800 000	
Travel	300 000	
Marketing	300 000	
Administration	200 000	
Miscellaneous	300 000	
Sectorial audit scheme		**900 000**
Three engineers	300 000	
Travel	100 000	
Administration	100 000	
Marketing	100 000	
Workshops/meetings	100 000	
Access costs	200 000	
Demonstration scheme		**2 000 000**
Four engineers	400 000	
Travel	100 000	
Administration	200 000	
Marketing	500 000	
Workshops/meetings	300 000	
Access costs	500 000	
Total		**6 600 000**

In addition research (including cogeneration) could be increased to about R2 million/annum. Including costs of the energy effectiveness group, government investment would be about R9,4 million/annum. This represents less than 0,1% of current industrial expenditure on energy.

7.3.3 Other countries

Table 5 shows public funding on energy effectiveness in all sectors of the economy in other countries. Since energy effectiveness planning is usually integrated for all sectors of the economy, no public funding statistics for industry could be found. The proposed South African industrial energy effectiveness budget in the medium-term, excluding research, was doubled to include estimated funding for other sectors of the economy. The table indicates that if South Africa were to embark on the proposed programme, government spending on energy effectiveness would still be modest compared to other countries.

Table 5. Annual public funding for energy effectiveness for the whole economy, excluding R&D

Country	Annual public funding ($million)	Public funding as a % of total energy cost
Australia[14]	10,6	0,041
Brazil[15]	34,0	0,048
France[13]	208,0	0,270
Korea[19]	20	0,045
Netherlands[14]	172,0	0,550
Portugal[14]	6,3	0,170
Thailand[18]	60,0	0,260
UK[14]	92,5	0,100
South Africa (proposed)[a]	4,2	0,032

[a] Exchange rate taken as R3,50/US$ and total energy cost is around 14% of GDP (R327 000 million in 1993) which is R45 800 million for 1993.

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APPENDIX A

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APPENDIX B

INTERNATIONAL ASSISTANCE AND TRAINING

The United States Agency for International Development (AID)

James Sullivan, Director
State Department
Room 508 SA-18
WASHINGTON, DC 20523
UNITED STATES OF AMERICA

Tel: (091)(703) 875-4610
Fax: (091)(703) 875-4053

Sponsors consultants to demonstrate implementation of energy efficiency programmes such as energy auditing methodologies and DSM programmes. Also gives grants for energy efficiency projects. Key objectives of AID are to encourage energy pricing reform, encourage energy efficiency, promote IRP, encourage use of renewable energy, and reduce greenhouse gas emissions. The agency supports an Energy Training Program which offers 2 to 7 months' training to governmental, parastatal, and private employers in developing countries. Categories of training include: energy policy and analysis, indigenous fossil fuel development, power industry development, energy conservation and efficiency, alternative energy systems, environmental policy and regulation, pollution control systems, and data collection and analysis.

International Institute for Energy Conservation (IIEC)

Deborah Bleviss, President
750 First Street NE, Suite 940
WASHINGTON, DC 20002
UNITED STATES OF AMERICA

Tel: (091)(202) 842-3388
Fax: (091)(202) 842-1565

World Energy Efficiency Association (WEEA)

Donald Guertin, Acting President
1616 H Street, NW, Suite 105
WASHINGTON DC 20006
UNITED STATES OF AMERICA

Tel: (091)(202) 347-9353
Fax: (091)(202) 737-5163

Energy Sector Energy Management Program (ESMAP)

The Manager: ESMAP
The World Bank
1818 H Street NW
WASHINGTON, DC 20433
UNITED STATES OF AMERICA

Established in 1983 as a joint program of the World Bank and the United Nations Development Program. Conducts studies into the need for energy efficiency improvements in a given sector, usually a sector of industry. Undertakes projects to assist developing countries' governments and implement end-use efficiency programmes, usually in the industrial sector.

Energy Technology Support Unit (ETSU)

A private company in the UK working closely with the Energy Efficiency Office. They possess a wealth of experience in dealing with industry on energy efficiency and marketing skills. It may be possible to place someone at ETSU for a few weeks to gain experience in their techniques. It would be necessary to write to the Energy Efficiency Office: International Relations, in this regard.

Energy Efficiency Office
Department of Energy
Eland House, Stag Place
LONDON SW1E 5DH
UNITED KINGDOM

Tel: (0944)(1) 273-0720
Fax: (0944)(1) 828-6983

Canada's Department of Energy, Mines, and Resources (EMR)

Canadian Energy Management and Environmental Training Program
Efficiency and Alternative Energy Branch
Department of Energy, Mines, and Resources
580 Booth Street
15th Floor, Energy Efficiency Division
OTTAWA, ONTARIO K1A 0E4
CANADA

Tel: (091)(613) 996-8131
Fax: (091)(613) 952-8169

EMR produces technical manuals on energy management for the commercial and industrial sectors. These manuals are useful resources on their own, although they are meant to accompany their energy management training courses. The training courses cover a wide spectrum of subjects. EMR is willing to sponsor courses in Canada or other countries.

Canadian International Development Agency (CIDA)

Stan Zaborowski
Energy Specialist: Professional Services Division
200 Promenade du Portage
HULL, QUEBEC K1Q 0G4
CANADA

Tel: (091)(819) 997-1492
Fax: (091)(819) 997-1491

Recently an CIDA-sponsored pilot industrial energy effectiveness project was completed for the SADC region. A five-year implementation plan has been designed and will be implemented shortly. The plan includes establishing sustainable training courses and an industrial audit and demonstration scheme. It may be possible for South Africa to establish links with the program and both contribute and gain experience. The program is to be co-ordinated from Harare. The address of the main co-ordinator is provided below, but it may change shortly.

Geoff Stiles
SADC Energy Management Project
ZBD House, c/o CAPSSA
99 Rotten Row
HARARE, ZIMBABWE

Tel: (09263)(4) 75-2011
Fax: (09263)(4) 79-6493

Demand-Side Management Training Institute

45 East City Line Ave
Suite 514
BALA CYNWYD, PA 19004
UNITED STATES OF AMERICA

Tel: (091)(215) 667-3350
Fax: (091)(215) 667-3346

Non-profit organization, funding derived from course fees and financial support of various organizations, provides training in DSM and IRP. In addition to providing training courses, it offers customized training to individual organizations.

The Association of Demand-Side Management Professionals

Elliot Boardman, Executive Director
7040 W Palmetto Park Road
Suite 2315
BOCA BATON, FA 33433
UNITED STATES OF AMERICA

Tel: (091)(407) 361-0023
Fax: (091)(407) 361-0027

The Association of Energy Engineers

4025 Pleasantdale Road,
Suite 420
ATLANTA, GA 30340-4264
UNITED STATES OF AMERICA

Tel: (091)(404) 447-5083
Fax: (091)(404) 446-3969

The association offers a variety of training programmes related to energy management.

REPORT NO. GEN 170

A STRATEGIC PLAN FOR IMPROVED INDUSTRIAL ENERGY EFFECTIVENESS IN SOUTH AFRICA (PART 3 OF 3)

FINAL REPORT

M G DE VILLIERS
R K DUTKIEWICZ

JUNE 1994

ENERGY RESEARCH INSTITUTE