THE IMPACT OF ELECTRICITY PRICE INCREASES AND RATIONING ON THE SOUTH AFRICAN ECONOMY

Potential energy savings: A review by sector

A review of potential incentives for promoting energy efficiency

Project Team

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Abbreviations

APDP	Automotive Production Development Programme
CFL	Compact Fluorescent Light
CIP	Critical Infrastructure Programme
DSM	demand-side management
DME	Department of Minerals and Energy
DTI	Department of Trade and Industry
DBSA	Development Bank of Southern Africa
EE	energy efficiency
EECIA	Energy Efficiency Capital Investment Allowance
EESP	Energy Efficiency Stimulation Programme
EIUG	Energy Intensive User Group
EIP	Enterprise Investment Programme
ECS	Eskom Conservation Scheme
HVAC	heating, cooling and ventilation
LRMC	Long Run Marginal Cost
LTMS	Long Term Mitigation Study
MTEPF	Medium Term Economic Policy Framework
M&V	Monitoring & Verification
MIDP	Motor Industries Development Programme
NERSA	National Energy Regulator of South Africa
NIPP	National Industrial Participation Programme
NRF	National Research Foundation (NRF)
PPA	Power Purchasing Agreements
REPSO	Renewable Energy Fund
SANERI	South Africa's National Energy Research Institute
SWH	solar water heater
SPII	Support Programme for Industrial Innovation
THRIP	Technology and Human Resources for Industry Programme
UNIDO	United Nations Industrial Development Organisation

Project terms of reference

Terms of reference

1. Sector insights have already been produced by the HSRC with WSP Consulting Engineers. It is proposed that these be prepared in the form of sector discussion notes and workshopped with a small group of experts from each of the manufacturing, mining, commercial and agricultural sectors.
2. A review of available investment incentives will be done, and recommendations for aligned incentives to encourage investments in energy efficient physical and process technologies will be made.

Scope and methodology

The sector insights will be developed via the following process:

- Short sector insight papers will prepared, of approximately two pages each.
- These will include commentary on known present energy efficiency (EE) levels and current/recent developments in each sector, and potential savings from candidate technologies (including co-generation). The barriers to further improvement of EE, including excise duties, will be listed and interrogated.
- These views will be debated in a workshop format with the specific industries in question.
- The insight papers will be revised based on these discussions.

Incentive proposals will be developed using the following methodology:

- A review of present tax concessions, import rebates and financial incentives will be compiled.
- A view on the efficacy of the above will be developed in relation to potential use aimed at incentivising physical and process technologies that are more energy efficient.
- Alternative incentive tools from other jurisdictions will be reviewed, where needed.
- A view on the likely uptake of energy efficient and co-generation technologies resulting from the suggested tools will be developed.

Deliverables

1) The background research and the workshop proceedings will be summarised and collated into a report.
2) A draft report will be circulated among the participants for comment.
3) After collation of the comments the document will be issued to the client electronically as a Final Draft report.
4) The Final Draft will be presented to the client electronically.
5) Three copy documents will be presented thereafter, at which stage the project will be considered completed.

Executive summary

Overall themes – the current reality

- A short-term respite from electrical shortages may be earned in South Africa via the global economic slow-down. The duration of this will possibly be as short as one year.
- Global reluctance to invest in non-renewable carbon and nuclear-based generation will result in carbon taxes, emission capping and further energy cost increases. These scenarios will be factored into global corporate strategy.
- A window of opportunity may be created by the Energy Intensive User Group (EIUG) who will voluntarily achieve 10% reductions. This will not be sufficient to avoid a negative or low reserve margin in 2010–12. Part of the above reductions may be behavioural and therefore reversible.
- Existing energy inefficient buildings make a significant contribution to the current and future energy problem. The commercial sector will not be impacted upon soon enough and sufficiently by the Eskom Conservation Scheme (ECS), and the emphasis will therefore need to be on moving this secondary and large user group towards EE, with the ECS implemented at municipal level on landlords/property owners. There is presently no economic rationale for a landlord to improve the EE of a building.
- Government is a major building owner and should be leading the way with improved EE. This will go a long way towards reducing the longer-term cost of government. Financing of the upgrades is a challenge given the constraints of the Public Finance and Administration Act and the difficulty of securing capital project finance.
- By making current electrical pricing cost-reflective the focus can be on the avoidance of Coal Powered Station #3, and the further adoption of EE practices.

Strategies to address the realities

- Action plans will need to be developed and co-ordinated to take advantage of the EE opportunities.
- The carbon tax of R0.02/kWh will need to be progressively increased to fund environmental improvements such as renewable power sources, when other cost increases abate.
- Corporate entities will factor in a carbon premium of €20–€30/Mt, and a clean energy strategy needs to be developed to encourage participation in the RSA economy. This may come to act as a stimulus or incentive to the development of cleaner industries.
- The EIUG needs to be allowed to show voluntary adoption of the ECS in order to avoid unproductive energy and resources being wasted in a war of attrition over baselines etc.
- The commercial and industrial sectors outside the EIUG need to be assisted with making energy usage reductions ahead of the increase in demand which may happen with an economic recovery.

- The National Energy Regulator of South Africa (NERSA) needs to push the pricing of electricity to levels which will reflect the current cost reality – in order to avoid one generation mortgaging the nation's future for the next. This need not impact negatively on the low-income sector; however non-technical losses (thefts) need to be addressed.
- The Department of Trade and Industry (DTI) needs to modify the current support systems for EE; this can be achieved via a programme of energy audit assistance, training support, and an investment support programme for industry.
- The funding for the support programmes will come from ECS penalties raised and via the United Nations Industrial Development Organisation (UNIDO).
- In order for government to be able to lead by example, the financing of government building EE upgrades by the Development Bank of Southern Africa or other state lending institutions needs to be made easily possible.

Incentives for energy efficiency

- Incentive tools exist or can be created that will encourage alternative energy investments, or will induce investment in physical or process technologies that could enable firms to be more energy-saving. They be broadly split into two general types: those which are tax-based and those which are grants. Essential to their sound structuring is that incentives are given to those businesses that actually can make EE improvements (not simply reductions in energy usage as a result of production cuts). Incentives should be paid in proportion to kW reductions – the measure of performance achievement. Incentives should be implemented with speed; on the part of both government and business.
- Of the tax-based incentives the investment allowances were discontinued from the South African tax system some years ago, but the accelerated write-off of the cost of capital expenditure is allowed. A 150% deduction of research and development operating expenditure and an accelerated capital write-off are also allowed.
- A number of incentive grants specific to EE are available in South Africa. These include the EESP and the REPSO incentive grants which are likely to be of considerable interest and value to businesses that are investing in EE improvements. Both are, however, contingent on the allocation of adequate funding.
- The EESP upper and lower thresholds will need to be altered in order to be of value to smaller businesses, particularly as might be generated within the agricultural sector, and to support substantial mining co-generation projects. Furthermore, the grant should be available to investments in agriculture as well as in the other three sectors.
- The REPSO fund may be of value to investors in wind, waste-to-energy or hydro technologies; however for assistance to larger wind projects the upper threshold will need to be increased.
- The feed-in tariff will be the main determinant of the REPSO renewable energy investmentuptake. A long term price certainly will ensure that a growing portions of R.S.A. power demands can be met via renewable energy sources.
- An Energy Efficiency Capital Investment Allowance (EECIA) is likely to stimulate the upgrade of HVAC and lighting in buildings. This will assist in overcoming the structural

problem and tension between landlord and tenant which is a barrier to efficient use of energy in rented buildings.

- Incentives which are able to boost training efforts and hence the numbers of energy engineers, certified energy managers and energy technicians entering the South African market are to be encouraged.

1. Insights on present and future energy efficiency in four major economic sectors

1.1. Introduction

The objective of the project and the intention of the workshop participants is to highlight what major developments and influences on energy efficiency (EE) are operating in four sectors of the South African economy.

1.2. Major developments and influences on energy efficiency

1.2.1. Pricing

The dominant influences on present planning and investment in EE improvements are **the risk of non-supply and the public perception** in response to the price determination of the National Energy Regulator of South Africa (NERSA) and as per Eskom and municipal tariffs.

The likelihood of real term price increases in excess of 25% over two, three or more years has reached most decision-makers in business. **This equals an electricity price increase of 250% in rand denomination over four years.** In order to avoid these costs the leaders in each industry sector have active investment programmes under way, and the followers in each sector are now planning the same.

Future electricity cost increase projections, the price curve signal or Long Run Marginal Cost (LRMC) of generating, are not publicised. It is submitted that business planners need to have access to official forecasts from the Department of Minerals and Energy (DME). If necessary a research project needs to be paid to maintain such an official view. The publicity around the process and the dynamics of the NERSA/Eskom negotiation are helpful in providing insight, but an official view needs to be adopted by the DME.

Future electricity prices will now build in a portion of pricing of renewable-based generation into pricing, as the diversification of energy sources is now part of the NERSA mandate, and feed-in tariffs for various categories of renewable energy generation have been announced.

1.2.2. Eskom Conservation Scheme

Businesses are impacted upon at either the supply or the demand end of the proposed Eskom Conservation Scheme (ECS). Developers and firms that are expanding facilities are in many cases unable to obtain the necessary electrical supplies and connections. Firms that are not able to curtail their electrical demand will be severely affected by penalties, but the response from the majority of businesses will, it is predicted, be to cut production in the short term to avoid penalties.

The ECS is viewed as essential to the addressing of the 'reserve margin' deficit. This is justifiable in terms of the argument that in order for the RSA economy to be able to grow in the next up-turn in the economic cycle, electrical supply capacity needs to be freed up by those who are using energy wastefully. **In the currently stressed economy it should be borne in mind that the residential sector, while responsible for about 33–37% (and growing) of the municipal peak demand, is not an economically productive sector.**

The prospect of Eskom and business being tied up in a long process of negotiation around baselines, and thereafter being involved in a series of lengthy disputes over penalties, is recognised and is something which all parties should be seeking to avoid.

The manner in which municipalities will gear up to be able to successfully implement the ECS is occupying the attention of Eskom. This is crucial to achieving energy usage reductions on the part of the greater number of smaller but significant commercial, manufacturing and agricultural sector energy users.

Recognition needs to be given by Eskom to the fact that many members of the Energy Intensive User Group (EIUG) have made progress towards improved EE. It is a fact that the mining industry, in particular, has plucked the 'low-hanging fruit'. It will be difficult for this sector to make significant further reductions in energy usage. Such reductions will be at the expense of low-grade shafts and marginal mining areas. The exercise is one of allocating profitable business units to the scarce resource (i.e. kW).

1.2.3. Global economic slow-down and reserve margin

The slow-down in world economies following on the 'sub-prime' problem in the USA has been dramatic. This has impacted on global commodity prices and mining businesses have begun to close any marginal operations. The closure of smelters in the ferro-chrome industry and others has caused a reduction in electricity demand and production. New platinum mining ventures and existing uranium mining production have been placed on hold. More responses of a similar kind must be anticipated from this industry. The likelihood of these ventures re-starting at some time is high; however, the recession will buy some time to allow the reserve margin to be partially restored.

Present ECS planning is done on the assumption of a 6.0% national economic growth rate. The impact on electrical power growth of a shrinking economy needs to be recalculated. It is viewed as important that the authorities do take advantage of the down-turn, and do not allow supply-side and demand-side activities to be delayed through more indecision and inactivity.

1.2.4. Demand-side management

There is still much scope for the improvement of EE in all sectors of the economy. **South Africa's energy intensity is about twice the global average**. Some business sectors, including mining, which have been proactively involved in reducing energy usage for some years, have the potential to fundamentally change their ways of operating such as to further reduce energy usage, but at considerable expense. If the global mining businesses are not to be discouraged from choosing South Africa as a venue for their activities, the demand-side management (DSM) programme or

other incentive schemes need to be on hand to ameliorate this situation. There are successful models of DSM support in the USA and in Europe, and the important attributes of these successful schemes need to be adopted. The suggestion is that the support is best run along programmatic lines, e.g. efficient motors, compact fluorescent lights (CFLs), energy audits etc.

The DSM programme as developed up to end March 2008 was saving over 400 MW per annum, and this was to rise to 800 MW with an accelerated programme. The NERSA price determination of 2008 did not provide for further funding of the programme.

The demise of the Eskom DSM programme has created a vacuum in the area of support for EE projects, which has been disastrous for a small group of energy service companies and unhelpful generally to the lowering of energy usage. Although Eskom has continued to support some pre-existing contracts, the DSM support activity is now focused on distributing free CFL bulbs. Funds to be supplied by Treasury for the DSM fund have not materialised, and the DSM scheme has all but collapsed and is unable to take on new projects. Some highly qualified and trained staff have been lost and some commendable aspects of the programme, such as the Monitoring & Verification (M&V) section, stand to be lost as a national resource. Any DSM programme cannot operate without the necessary checks and balances; an **independent** M&V section can continue to provide such services to Eskom, and to other agencies such as municipalities and the central government (DME or DTI), if the funding for DSM-type activities is found.

It would be logical for DSM activities be partially funded from ECS penalties. These funds could resuscitate the DSM activities. Businesses can then be encouraged to adopt SANS 798 – Energy Management Systems, and to employ energy audits, in order to uncover the potential of DSM projects within their operations.

1.2.5. Co-generation and renewable energy projects.

The current model for the rules of Power Purchasing Agreements (PPA) of a nominated 'single purchaser' has resulted in the unintended consequences that are discouraging renewable energy and co-generation. The present PPA rules do not provide certainty, lack long-term guarantees of off-take, and provide a perverse reduction of long-term prices.

Many renewable energy generation projects are being planned, but these could have been stillborn without a revision of the 'grid-feeder law' in South Africa. In order to ensure the success of these projects, the principle has been that the PPA provides that every generating technology has its own (economic) purchase price, which is gazetted. **In order to attract international and national investors, and to overcome negative risk perceptions about Southern Africa, the standard fixed price feed-in contracts should be long-term (25 years) and the tariffs better than the leading nation's contracts.** Similarly, a decrement factor reflecting the accelerated learning curve should be allowed for.

1.2.6. Environmental aspects

The possibilities of greater international agreement on global carbon emissions reductions, with the inclusion of China, India and the USA, are viewed as increasingly likely. This global reality will mean that countries such as South Africa will be under pressure to exact penalties for excessive carbon emissions, and will therefore impose emission caps. Increasingly global businesses are

therefore planning their activities to build in the expectation of a carbon tax of the order of €20–€30/Mt on coal or non-renewable energy sources, or alternatively R0.25–R0.40/kW.

The Long Term Mitigation Study (LTMS) proposal of the Department of the Environment is accepted government policy. If the CO_2 emission targets of 2050 are to be reached, the present R0.02/kWh will need to be steadily increased **in an orderly fashion, thereby according decision-makers ample time to adjust their planning,** and this funding should then be used to fund investments in clean electricity generation.

1.3. Sector analysis

1.3.1. Manufacturing

The manufacturing sector uses 25% of the electrical energy used in South Africa. Within the manufacturing sector there is a large diversity of energy intensity across businesses. Some fall into the EIUG – such as the cement producers, who have made significant advances in EE. Other businesses are less energy-intensive, but nevertheless electrical energy is a crucial component of their production, from either a cost or an availability perspective.

Unscheduled power cuts can have varying implications for the manufacturing industry, depending on the nature of production. One cross-cutting impact may be that an unfair distribution of load shedding or cuts may create competitive advantage or disadvantage for some manufacturers relative to others.

The initial reaction of manufacturers to the spectre of further power cuts has been to install **fossil fuel-driven** electrical generators. Businesses have been able to secure themselves in this way, at some expense. It would be environmentally undesirable to impose penalties on electricity users such as to encourage the prolonged use of generators. With the current cost of diesel-generated power running at between R1.60 and R2.00 per kW, it would appear that some manufacturers will be pushed into this as a cheaper alternative to paying ECS penalties.

There is concern that ECS baselines will not be agreed on without disputes, resulting in the distraction of management and power disconnections.

The need for incentives to encourage the energy audit and Energy Efficiency Investment Assistance schemes is considered to be an important counter-balance to these penalties.

Some of the clear opportunities for power savings include:

- installation of bulk check metering and sub-metering;
- installation of power factor correction;
- installation of remote motion sensing connected to the lighting component in plant and buildings;
- energy-efficient lighting in the plant and administration areas;

- changes in the load profile if possible – that is, running energy-intensive processes at night or during off-peak periods;
- developing motor efficiency programmes in an in situ diagnostic monitoring programme and a core replacement programme; and
- co-generation opportunities.

Co-generation is widely practised in the sugar and pulp and paper industries, and to a lesser extent in the petro-chemical industry. Less than 300 MW of electricity is currently produced through co-generation; however, it is believed that 2 000 MW is achievable within two years. Factors that could accelerate the number of co-generation projects include:

- streamlining the current Eskom approval process;
- allowing a full write-off for tax of the capital cost in the first year;
- selling electricity produced through co-generation back to the grid at higher prices;
- publishing co-generation feed-in tariffs to assist in expediting the process and incentivising potential co-generators;
- streamlining of the current 100-page PPA;
- resolution of the asymmetry of risk uptake that exists in proposed PPAs between the seller and buyer;
- fast-tracking Environmental Impact Assessment Records of Decision for co-generation projects;
- defining rules between co-generation and Power Conservation Programme requirements;
- introducing a production tariff (premium) for Independent Power Producers that will ensure commercial viability over the lifetime of a project, and should be unique to each project; and
- extending Eskom's single buyer model to RE generators.

With the exception of co-generation, all of the above-mentioned potential power-saving measures can be achieved in the short term.

Co-generation is the main medium-term opportunity. Co-generation potential provided by Business Unity South Africa members in the sector includes a range of projects and possibilities:

- Co-generation opportunities exist within the motor industry, with particular reference to wind generation at industry sites in the Eastern Cape.
- Co-generation opportunities exist in the brewing industry where methane from waste water plants which is currently flared can be used in gas reciprocating engines to generate electricity.
- Eskom is budgeting for at least 3 500 MW of co-generation.
- Eskom has received proposals for approximately 100 co-generation projects with a total generation capacity of 5 000 MW. The largest are between 300 MW and 400 MW, while the majority of the projects are below 100 MW.

- Sasol Secunda has approved a co-generation plant of 280 MW.
- ArcelorMittal is proposing a 110 MW plant at its Vanderbijlpark Works.
- Tongaat-Hulett is in the planning stages of its 60 MW plant.

1.3.2. Agriculture

The agricultural sector sources only 24% of its energy requirements from electrical sources in South Africa. This sector also includes among its members a large diversity of energy intensity, ranging from those involved with large-scale freezing and refrigeration to pastoral farmers with low energy intensity.

Some 50% of all electricity is used for pumping water. It is **currently** cheaper for farmers to pump/irrigate using electrical power rather than diesel or biodiesel. **The impact of increased fuel prices, increased electricity tariffs, blackouts, water problems and quadrupled fertiliser prices (fossil fuel-derived) is already affecting food security in South Africa.** Backup diesel-powered generation is available on most farms, but improvements in EE can be achieved to reduce the backup requirement.

No significant energy savings opportunities exist, although milling and pumping can be shifted into off-peak periods. Significant generating potential exists with the production of methane from the biological digestion of animal and vegetable waste and subsequent electrical generation via gas burning engines.

The effects of rolling black-outs on this sector have been and can be severe. This is particularly the case in the dairy, poultry and aquaculture sectors. Several factors need to be considered:

- Milling companies, abattoirs and processing plants have been and will be affected negatively.
- Farms under irrigation generally draw irrigation from state irrigation schemes in terms of a permit. Irrigation schedules are spread over 24 hours to ensure balanced use of the water. Interruption of power disrupts the schedules and may result in farmers not being able to draw water in terms of their schedule. Specific tariff schemes to incentivise irrigation outside of normal peak times are already in place.
- A wide range of agricultural products has to be maintained at a low temperature from the farm to retail. Any disruption in this cold chain can destroy produce, including milk, meat, and some fruit and vegetables. The same applies to the fishing industry.
- Most biological processes require specific temperatures to be maintained for the duration of a particular process. In the case of some products like wine, disruption can result in the loss of a whole crop.
- Automated feeding systems can generally not be used manually and unplanned disruptions can result in large-scale deaths of livestock.

The agriculture industry recognises the need to make a contribution to the current energy situation, but needs load shedding to be well scheduled and advance warnings to be reliable. It is recognised that the current approach to load shedding is an improvement on the earlier efforts. It is imperative that the sector monitors the impact with better advance warning and makes adjustments where necessary.

1.3.3. Mining

The electricity crisis of January 2008 was stabilised as a result of the mining and refining sector reducing off-take, and the sector has since this period been used to cushion the other market sectors. Mining has only been able to do this by reducing production, and t**his came at a price to the national economy.** The industry's efforts to reduce energy usage in the second and third quarters of 2008 were varied across operators and operations, but were reasonably successful.

It is agreed that even the more developed modern mines are in a position to reduce energy usage still further. In the main this will be achieved by concentrating investments at higher-grade ore bodies, and mining rock which has inherently lower energy costs. Technologies are available to achieve such improvements (see section 1.4.3 below).

Process energy is reported to absorb two-thirds of energy in mines and only one-third in actual rock drilling and hoisting. Hauling, milling and refining constitute the process energy, and these aspects will need to receive much attention. Pumping, cooling and ventilation consume about 50% of the total power used by deep level mining.

In the very short term it is only really possible to make savings without affecting production in two areas – hostels and administration offices. These two areas constitute a relatively small percentage of the total power used. It is therefore unlikely that a 10% saving could be achieved in the short term without affecting production.

If forced to achieve a 10% saving in the short term, the mines will most probably stop working those shafts with a lower ore grade. This means closing a whole shaft, which would entail a loss of income and/or employment for unskilled/semi-skilled staff. The other short-term possibility is the introduction of power factor correction, but most mines have installed this already.

Medium-term savings in the mining sector could be achieved in the following ways:

- removing hostels and housing compounds from the grid and supplying these with power derived from solar water heating, bio-energy plants and photovoltaic cells. This would reduce demand by up to 4.5 MW per shaft;
- use of the three-chamber pipe feed system to move hot water up and out of the mine;
- use of mill power optimisation technology;
- implementation of a variable speed drive programme for appropriate motor technology;
- use of electric drilling programmes, which reduce the compressed air component significantly;
- remote sensing to reduce light usage on the plant;
- waste heat capture to produce hot water for the ablution facilities;

- motor efficiency programmes that can be (and are being) implemented by developing an *in situ* monitoring and diagnostic programme and a core replacement programme;

- bulk energy storage on site, which can act as a security power supply as well as displacing load during peak periods. Load shifting programmes are a major contributing factor to reduce the current strain on the generation base and significant savings have and can be achieved in this area;
- the use of ice plants in lieu of chilled water refrigeration plants, which can reduce the energy requirements in refrigeration and pumping. Moreover, using hard ice technology is even more energy-efficient than vacuum ice technology. Most of the mining groups have started to use vacuum ice technology sporadically, but there is very limited use of hard ice technology.

There is potential to install at least 50 such plants. At the current cost of electricity, the payback period would be more than 10 years, which means mines would not readily install these plants without some support, such as a tax incentive.

Factors preventing mines from adopting the above energy-saving measures include: a shortage of specialist skills; the high capital cost of some of these plants; the low cost of electricity; the ore grade of the particular mine; and the fact that ice plants are only viable for deep-level mines because of the increased pumping costs.

1.3.4. Commercial

In this sector particularly, energy usage is the result of the behaviour of individual people, and hence by changing behaviours it can be reduced. Energy usage in the commercial sector occurs within buildings, mainly by way of lighting and heating, cooling and ventilation (HVAC). The building design and the thermal resistance of the shell can have a major influence on the EE of a building.

Energy for commercial customers is mainly supplied by municipalities. The capacity of the billing systems of the municipal finance departments to implement the ECS is in general not considered to be adequate. The impact on the ECS (via municipalities) therefore may not be felt in the short term. Furthermore, landlords will be in a position to simply on-charge the penalties to their tenants, however the legality of this practice is likely to be contested.

It should be possible for shopping centres to achieve a 10% reduction in power consumption relatively easily:

- Immediate savings can be achieved by the introduction of low-energy light fittings and the remote sensing and switching of these lights so that they only come on when the space is occupied. Similarly, outside lights could be changed to energy-efficient fittings.
- HVAC systems can be set at 1 ^{o}C or 2 ^{o}C warmer (in winter) or colder (in summer), and can be linked to timers and monitoring systems to reduce the overall HVAC energy load during peak periods.

- All escalators can be retrofitted with timers and sensors to ensure optimum energy efficiency.

The potential extent of savings also depends on the extent to which retailers or centres have turned to generators as an alternative source of power.. However, generators only cover the 'emergency' load – lighting and refrigeration – and not HVAC (air conditioning). Additionally, even at higher electricity prices, electricity would still be cheaper than generation. Therefore, even those retailers that have generators will only run them during blackout periods.

It is suggested that Eskom engage with the South African Property Owners Association to develop a co-operative approach which will ensure that this sector is more proactive in reducing energy usage ahead of the implementation of the ECS.

Tenants can be encouraged to make capital expenditure EE improvements in terms of their leases, with tax deductions. An accelerated write-off of EE capital expenditure allowances for landlords and building owners is recommended.

The rapid and orderly introduction of energy labelling of new (as per SANS 204) and existing buildings is a low-cost way of using market mechanisms to achieve energy awareness and efficiency in this sector.

1.4. Candidate technologies

1.4.1. Manufacturing

Some short-term gains will have been achieved by way of switching to efficient lighting, and by using sensors and switches to prevent wastage.

The major EE gains will in future be from efficient motors and (variable speed) drives for fans, pumps and conveyors. By using modern lighting (inc. high bay), compressed air and heat recovery and by replacing boilers with combined heat and power plants, further gains can be made. These technologies will require significant investment, but with financial support for energy audits, and incentives for capital cost spending, energy savings of approximately 20% are achievable.

1.4.2. Agriculture

Some quick but relatively small energy savings can be made in the offices and residential accommodation on farms with efficient lighting (CFLs) and solar water heating.

Small-scale hydro-generation, pump storage, solar and wind-powered pumping can contribute to the EE of farms in the future. The potential of co-generation (producing electricity from burning methane which is produced in biological digestion plants) is large, and can be applied to pig, poultry and cattle manure. It is envisaged that packaged plants will be offered to the market.

These technologies and others could be supported by way of programmatic DSM and grant schemes.

1.4.3. Mining

Much can be gained, even in the short term, by the prevention of leaks and ex-filtration into worked-out stopes, and also by repairing leaks to the compressed air systems. Similarly, regular conveyor idler inspections are necessary. Maintenance management and staff training are at the heart of success in this area.

A systems approach to the analysis of the energy usage through the process flow is needed to address the energy savings areas optimally. It is estimated that even after initial gains, a further 25% reduction in energy usage will be achieved in future years.

The major gains in the mining industry to be had in the medium term are by way of compressed air (correct specifications, reduced pressures and with variable speed drives), from the refrigeration applications (ice slurry, hard ice), and from the many applications of motors (fans, pumps, conveyors), where the load is more accurately matched to the motor and drive.

Co-generation opportunities, present where chemical reduction is taking place (in the presence of coal) and in cases where there are combined heat and power technologies, can replace conventional boilers.

1.4.4. Commercial

By addressing behavioural aspects of usage, much wastage can be eliminated in buildings, in the short term. HVAC application savings can be made by adjusting set points. These measures can save 10–30% of initial usage.

These gains can be made more permanent by installing sensors on lighting switches, to allow for low occupancy or day-lighting, and by installing HVAC controllers.

Modern chillers are inherently much more efficient than old technology, and coupled with more efficient lamps, luminaires and electronic ballasts, energy usage in buildings can be halved in the medium term.

1.5. Barriers to energy efficiency

The uptake of EE in South Africa is inhibited by the following factors:

1.5.1. Market distortions

It is submitted that electricity costs have been held down artificially, in accounting terms, by not reflecting the current costs, but instead reflecting historic costs in the Eskom financial statements. This could have been avoided by regularly re-valuing the generating asset base, and showing the increasing capital cost in the annual depreciation allowances.

The effect of not following the above practice has resulted in Eskom not being awarded necessary price increases, which has in turn resulted in the delayed expansion of the generating assets. The

positive side of this policy has, however, been the stimulation of certain mining and industrial sectors with this cheap electricity.

The threat of global warming is a catastrophe which affects all countries and peoples. The failure of the market to reflect the global emissions threat has necessitated the intervention of governments. The case for excluding developing nations from making commitments to support the international treaties is weak. How long will relative wealth be a reason or licence to destroy the environment? The major part of the cost of intervention to address the global emission problem will still need to be carried primarily by the major economies of the world, and this will include electricity users in South Africa. **Sub-Saharan Africa is at a higher risk than most other areas.**

1.5.2. Financial benefit

Implementing EE costs money and business will move to EE when it makes economic sense to do so.

In the absence of cost reflectivity in the pricing of electricity, the efficiency of usage will reflect an artificial situation. In a South African context cheap electricity has encouraged profligacy.

Conversely the pricing signals which point to rising energy costs will now stimulate investment in EE in order to reduce costs.

Landlords will not voluntarily make EE-improving investments in their buildings without some form **of incentive** or tax write-off. They can be a barrier to positive change and can simply pass on the higher energy costs and penalties via the ECS, or they can be proactive in helping tenants to avoid having to pay a share of the ECS penalties.

1.5.3. Penalties for excessive energy usage and EE incentives

The ECS may be a barrier to the continued existence of certain energy-inefficient businesses, but it will provide that power is available for new entrants, and new developments. The ECS is in part the consequence of a period of availability of artificially cheap energy.

The energy-inefficient practices of the past ways of operating businesses will make way for more efficient businesses. Businesses will adapt to the new paradigm. To prop up the old 'smoke stack' industries with subsidies and incentives **within South Africa or across the borders** will be a mistake.

The rationale for the incentivisation of EE improvement and energy investments relates mainly to the creation or preservation of employment. The argument for both 'carrot and stick' approaches, it seems, has no rational basis, but it has a basis in the inherent fairness it demonstrates.

Incentive schemes are inevitably bureaucratic and **potentially open to abuse**. If kept simple they have a good chance of working to produce the desired result – an accelerated uptake of EE.

Essential to their sound structuring is that incentives are given to those businesses that actually can make EE improvements (not simply reductions in energy usage as a result of production cuts). Incentives should be paid in proportion to kW reductions – the measure of performance

achievement. Incentives should be implemented with speed; on the part of both government and business.

1.5.4. Information availability

Poor decision-making may result from the lack of thorough research, and the paucity of information available in the public domain. As the decisions taken in the energy and electrical generation industries can have major consequences for the state of the national economy, the information provided needs to be accurate and reliable.

In the past highly informative reviews of the state of energy in South Africa (such as *Energy Futures*), were published and made available in the public domain. Statistics South Africa should be able to make available EE and renewable energy data and information such as the LRMC of electrical generation. Data on the energy intensity of industries and buildings should also be available.

Energy research in South Africa is undertaken under the auspices of South Africa's National Energy Research Institute (SANERI) and the National Research Foundation (NRF), and it is perhaps incumbent on these organisations to address the above problems.

2. Development of an Energy Efficiency Incentive Proposal

The objective of the project and the intention of the workshop participants is to highlight what measures are considered important in a successful package of tools which, if applied by government, are likely to successfully stimulate the development of EE in four economic sectors.

These incentive tools will encourage alternative energy investments, or will induce investment in physical or process technologies that could enable firms to be more energy-saving.

The project is not a comprehensive review of all likely incentives, but intends to offer suggestions on gaps and ways of improving the total array of incentives.

2.1. Existing incentives and tax concessions available to energy efficiency

The workshop delegates considered incentives which may be broadly split into two general types, those which are tax-based and those which are grants, and recognised that many incentives are in place which can be applied to EE-driven measures and investments.

2.1.1. Tax-based incentives

Of the tax-based incentives the investment allowances were discontinued from the South African tax system some years ago, but the accelerated write-off of the cost of capital expenditure is allowed. The proportion of write-off in each of three years is 50/30/20. A 150% deduction of research and development operating expenditure and an accelerated capital write-off are also allowed.

In the commercial sector landlords may not deduct the capital cost of any building improvements (or EE improvements) against rental income. The costs of running central HVAC and chillers are generally distributed among tenants, and are therefore fully recovered. However it is **currently** not in the **monetary** interests of a landlord to upgrade a building for EE.

This inherent barrier to the improvement of rented buildings, it is submitted, can only be corrected with an appropriately structured tax-based incentive.

The problem does not present in the industrial , mining and agricultural sectors because wear-and-tear allowances do provide for the write-off of capital plant over a reasonably short period.

2.1.2. Incentive grants

Grants specific to EE and available in South Africa are:

1) Demand-side management

   The DSM fund is managed by Eskom and has supported an investment in energy-saving devices for five or six years. The cost of the programme is recoverable in the electricity tariff. The programme was intended to be driven by energy service companies, some of which are vendors of EE equipment or devices. Expenditure in the year ending March 2008 was approximately R800 million, for which some 400 MW was saved.

   This return of megawatts of demand reduction is considered very cheap in relation to the alternative of building new generating equipment, and should be continued, even under Eskom management rather than not at all.

2) Eskom solar water heaters (SWHs)

   Eskom has promoted a programme in support of SWHs which offers some R2 000–R3 000 on the cost of between R15 000–R20 000, funded out of the DSM fund. The programme has not achieved its targets. This programme would appear to hold great promise for stimulating energy usage reduction as the SWH industry gears up to provide greater volumes.

3) Energy Efficient Motors Programme

   This programme supports the cost of replacing older electric motors with new, energy-efficient motors. The counterpart programme in the UK is reported to be highly successful.

   The payout amounts are paltry in relation to the cost of installing the new motors, and probably as a result the uptake on this programme is reported to be very low.

4) Renewable Energy Fund (REPSO)

This programme is funded by the DME. Support of R250 per kW is available for renewable energy projects of a size from a minimum of 1 MW, for projects up to R100 million.

The fund may be of value to investors in wind or hydro technologies.

5) Enterprise Investment Programme (EIP)

This programme has a hurdle of 50% of historical fixed (not depreciated) capital in order to qualify and therefore EE projects are extremely unlikely to benefit. The hurdle is set at 30% for clothing and textiles.

Unless the hurdle is changed only the EE investment that is part of an expansion has the potential to be included.

6) Motor Industries Development Programme (MIDP) and Automotive Production Development Programme (APDP)

The MIDP is funded by a rebate of imports, and is more than five times larger than all other programmes combined at some R7 billion per annum. It is administered by the DTI.

The impact on EE is not built into the programme.

The APDP has an Automotive Investment Allowance similar to the EIP which could cover some EE component of the expansions.

7) Black Business Supplier Development Programme

This scheme is an 80 : 20 cost-sharing grant designed to advance small businesses which are owned by previously disadvantaged individuals. It is administered by the DTI.

EE could be part of its mission statement or performance criteria.

8) Critical Infrastructure Programme (CIP)

The support from the CIP is a non-refundable cash grant that is available to the approved beneficiary upon the completion of the infrastructure project. The scheme covers between 10% and 30% of the total development costs of the qualifying infrastructure. The scheme is administered by the DTI.

This fund may be useful in generating renewable energy and EE projects.

9) Technology and Human Resources for Industry Programme (THRIP)

THRIP is a partnership programme which facilitates business- and government-shared funding of innovative research in South Africa. This programme is administered by the National Research Institute, but has been downscaled.

This programme has been used to fund research into energy-related subjects, in partnerships between universities and organised industry.

Support Programme for Industrial Innovation (SPII) and National Industrial Participation Programme (NIPP)

These two funds are very small, and are administered by the Industrial Development Corporation and the DTI respectively. SPII and PII could be used to fund innovative technology introduced by the developer. Their potential impact is therefore constrained.

10) Energy Efficiency Stimulation Programme (EESP)

The DTI has initiated and is intending to implement an incentive designed to stimulate investment in EE, in line with the South African government's National Energy Efficiency Strategy. The primary objective of the EESP is to stimulate investment in improved EE initiatives.

The incentive programme aims to enhance the EE in manufacturing, mining and commercial enterprises of all sizes. The programme provides investment support to both local- and foreign-owned entities, by offering an investment grant of up to 50% of the value of qualifying investment costs in EE equipment.

The details of the investment grant are as follows:

- Investment projects of R5 million and below may qualify for an investment grant equal to 50% of their total qualifying investment cost, payable over a three-year period. The third year is payable subject to the project achieving the estimated EE improvement, as detailed in Section 3.
- Investment projects of above R5 million may qualify for an investment grant of between 30% and 50% of their qualifying investment costs, calculated on a regressive scale (as detailed in Section 4), and payable over a period of two years. This investment grant cannot exceed R30 million.
- In all cases, grant payment is subject to the approved project achieving the stipulated performance requirements of EE specified in Section 3.

Initial comments made on this proposal are that the R5 million threshold is too high, and the R30 million one is too low. Furthermore, the grant should be available to investments in agriculture as well as in the other three sectors.

It is not clear if the grant is taxable or tax free as under the EIP.

If these aspects can be addressed this programme can be a major contributor to improved EE.

11) UNIDO support for energy audits and training

It is reported that the United Nations Industrial Development Organisation (UNIDO) is interested in providing support funding to aid the rollout of energy audits. This assistance is currently available via the National Cleaner Production Centre of the DTI, and has been successfully initiated.

UNIDO is also planning to assist by funding training in EE.

12) Development Bank of Southern Africa (DBSA)

The funding of improvements to EE in the public sector, and more specifically in government departments, by the DBSA via a standard product could assist in reducing the long-term cost of government.

13) Other programmes

It is suggested that offset programmes such as that for weapons procurement could be guided into investing in EE technologies and the commercialisation thereof.

Further specific programmes which are unlikely to be of use to enhancing EE or reducing energy usage are:

- BPO and O
- the Sector Specific Assistance Scheme (SSAS)
- the Co-operative Incentive Scheme (CIS)
- the Emerging Entrepreneur Scheme
- the Credit Guarantee Scheme.

2.2. Incentives schemes in overseas jurisdictions

The success of the grid-feeder law in Europe and the Energy Efficient Motor Replacement programme in the UK are offered as models for South Africa to follow.

The USA also has, at state level, a myriad of innovative EE programmes, both tax-based and grant-based. These are reportedly having a positive effect on reducing energy usage.

2.3. Summary view of the efficacy and likely uptake of incentives

Table 1 – Summary of incentives

Incentive descriptor	Abbrev.	Beneficiaries	Managing agency	Potential value to beneficiary	Potential number of projects annually[2]	Est. energy impact (GWh)[2]	Est. demand reduced (MW)[2]	Cost of incentive[2]
Energy Efficiency Stimulation Programme	EESP	All industry and commerce	DTI	R100 000– R30 million (average R5 million)	1 000	2.5	625	R1.5 billion
Renewable Energy Programme	REPSO	Renewable energy generators	DME	R100 million	2	1.6	800	R0.2 billion
Energy audits	EA	All industry and commerce	DTI & UNIDO	R25 000	1 000	1 000.0	125	R25 million
DBSA Public Finance	DBSA	Government buildings	DBSA	R600 million per annum	1 000	2.5	625	R0.15 billion[1]
Capital allowance – EE improvements to rented commercial & industrial buildings	EECIA	Landlords for commercial & industrial buildings	SARS	EE improve-ments written off over the period of a lease	1 000	2.5	625	R450 million

Notes:

1 Interest at 10% per annum

2 Illustrative

The EESP and the REPSO incentive grants are likely to be of considerable interest and value to businesses that are investing in EE improvements. Both are, however, contingent on the allocation of adequate funding which has probably not occurred in the Medium Term Economic Policy Framework (MTEPF).

The EESP threshold will need to be reduced to the order of R100 000 in order to be of value to smaller businesses, particularly as might be generated within the agricultural sector. The upper limit of project size should be at least R100 million in order to be able to support substantial mining co-generation projects. Furthermore, the grant should be available to investments in agriculture as well as in the other three sectors.

The REPSO fund may be of value to investors in wind, waste-to-energy or hydro technologies; however for assistance to larger wind projects the upper threshold will need to be increased. The feed-in tariff will be the main determinant of the REPSO uptake.

The support of energy audits by the NCPC has proven to be of great value to businesses in the chemical sector, and is recommended for support by government and UNIDO.

If the DBSA is able to develop a well publicised financing product which can be used by government departments to make investments in EE, their electricity costs can be reduced and they will be in a position to take the lead in office space energy usage.

An Energy Efficiency Capital Investment Allowance (EECIA) is likely to stimulate the upgrade of HVAC and lighting in buildings. This will assist in overcoming the structural problem and tension between landlord and tenant which is a barrier to efficient use of energy in rented buildings.

Incentives which are able to boost training efforts and hence the numbers of energy engineers, certified energy managers and energy technicians entering the South African market are to be encouraged. This is as per the efforts of the Engineering Council of South Africa and the late Dr Ian Lane, as well as UNIDO. As the need for energy experts is now well publicised and the relevant training is offered, it is anticipated that market forces will operate to correct the present shortage of expertise.