

ENERGY EFFICIENCY IN AFRICA FOR SUSTAINABLE DEVELOPMENT: A SOUTH AFRICAN PERSPECTIVE

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ABSTRACT

As countries come under increasing pressure to meet conflicting demands to improve the quality of life of the population and limit emissions associated with power generation, more attention is focussing on energy efficiency as a means to achieve these goals.

Although energy efficiency was topical at the time of the oil price increases in the 1970's, there was a period after that with economic growth and little concern for the environment. However, increasing publicity for climate change issues has resulted in an increased interest in ways to limit greenhouse gases while at the same time not adversely affecting economic growth. Energy efficiency has been identified as a technique with enormous potential to achieve this goal.

In South Africa, an additional incentive to adopt energy efficiency measures has emerged from a somewhat surprising source, the national electricity utility, Eskom, for reasons of demand-side management.

This paper investigates recent work in the field of energy efficiency in South Africa and discusses the way ahead as well as what is required to maximise the benefits that could be obtained from energy efficiency.

Suggestions are also made where collaborative ventures could be considered as a means to maximise output from the limited skilled manpower resources available in the sub-continent.

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Introduction

Environmentalists have for many years argued the case for energy conservation and energy efficiency. They have argued that we have a responsibility to minimise the negative effects of energy use on our environment, in terms of pollution, climate change and resource depletion.

Other groupings have argued that cheap (and dirty) energy is the engine driving economic development and social upliftment. For many years, it was this group that dictated the way we used energy.

In recent times, a change has occurred, especially in the developed world. The concept of "sustainability" has woken many to the fact that the developed world will have to seek a new direction if they are to maintain or improve their quality of life further. Energy efficiency has gained new respectability as a cost-effective means to approach sustainability and many initiatives in this area are to be seen. The two primary drivers for the implementation of energy efficiency measures are finance and the environment.

Financial Benefits of Energy Efficiency

There are countless examples of companies that have made significant financial and energy savings by introducing energy efficiency programmes. One therefore has to question why the adoption of these measures has not been universal. The answer to that can usually be found in one or more of the following reasons:

- **I know my business best.** No one can tell me how to run my business. Besides, no one outside the industry understands my energy problems like I do. This attitude is often accompanied by a concern that I will appear incompetent if outsiders identify savings that I have not seen.
- **Resistance to change.** Everything is going along just fine. Why must we continually be changing and trying new things that will probably not work anyway.
- **Energy is too cheap.** Many users see energy as a minor input cost, relative to raw material and labour, and tend to concentrate on these. Very often, education and examples can provide the incentive for these users to take another look at energy.

- **Lack of capital.** Some energy efficiency measures involve the installation of expensive capital equipment. Users are nervous that the promises made by zealous salespersons may not be realised. Once again, education and objective information can go a long way to overcome these misgivings.
- **Uncertainty regarding the future.** Investors are sometimes reluctant to commit resources to long-term projects, given the financial instability both internationally and within regions. Payback periods need to be measured in terms of months rather than years, and this can exclude energy efficiency investment opportunities. The lack of long-term commitment has been an on-going problem in Africa with many investors seeing better business opportunities in other regions of the world.

Given the above concerns, there is still abundant evidence that energy efficiency programmes almost always make economic sense, whether in the industrial, transport, agricultural or residential sector.

At a more general level, energy efficiency measures benefit the country's economy in a number of important ways. Reduced imports of energy resources have a positive effect on the balance of payments, while optimised use of a country's power stations will delay the need for investment in increased generating capacity. This is particularly relevant in large parts of Africa, where installed capacity is lagging behind demand for electricity.

Environmental Benefits of Energy Efficiency

The environmental benefits of energy efficiency are self-evident. Use less energy and emit less pollutants and greenhouse gases. A further environmental saving is realised if the energy efficiency measure results in more efficient conversion of the energy resources. This saving becomes evident in the form of reduced gas emissions and reduced depletion of energy resources.

The issue of greenhouse gases and the spin-off of carbon trading could be of particular relevance to Africa and deserves some attention.

- **Greenhouse Gases.** The Kyoto Protocol on global warming was adopted by nearly 180 countries in Japan in 1997. It committed 38 industrialised countries to cutting their emission of greenhouse gases to 5.2% below the 1990 levels by 2012.

In March 2001, the United States President, George W Bush, surprised the world by announcing that the accord would not be submitted to the US Senate for ratification. He argued that it was fundamentally flawed and

not in the economic interest of the United States. Since the US contributes about 30% of the world's greenhouse gases, this decision was disappointing, especially when reports issued by the UN's Intergovernmental Panel on Climate Change (IPCC) have indicated that global warming was linked not to natural fluctuations but to human activities in the form of greenhouse gas emissions.

For a time it appeared that the protocol would fall apart, but at a meeting in Bonn during July 2001, agreement was reached by participating countries (without the USA) and the accord was signed. There is some doubt whether any agreement will be effective without the participation of the United States.

Among the provisions of the Bonn deal, the Clean Development Mechanism (CDM) is of particular interest to Africa and to energy efficiency initiatives. This is a mechanism to allow industrialised countries to offset some of their emissions at home by paying for carbon saving projects in developing countries including the transfer of renewable and cleaner energy technologies (excluding big dams and nuclear power). Developed countries can also earn credits by paying for reforestation in poor countries.

South Africa – What has been done so far?

Following the oil shocks of 1973 and 1979, the emphasis on energy efficiency was in the area of liquid fuels. The United Nations oil embargo placed on the previous government emphasised the need for conservation measures and alternative sources of supply. The SASOL oil-from-coal plants were expanded, and large oil stockpiles were created.

With the changing political climate that led ultimately to a change in government in 1994, the emphasis on self-reliance diminished and with it, the emphasis on energy conservation, especially of liquid fuels.

Having been accepted back into the world community, South Africa found it had to compete globally, often with equipment and plant inherited from an era of isolation. The economy was required to move from a protected, survival mode to one of open markets. As part of this modernisation process, energy once again came under the spotlight.

During the 1990's the European Commission saw an apparent opportunity to export the latest energy efficient technologies and techniques to South Africa. A delegation that visited South Africa was surprised to find how uneducated a large proportion of the industrial sector was to energy efficiency possibilities.

An outcome of the visit was the decision to sponsor energy scans/audits in three high-profile South African companies, to demonstrate to smaller users that even where companies are aware of energy conservation possibilities, the potential for savings still exist.

The three companies that participated in the project were:

- South African Breweries
- South African Pulp and Paper Industries (SAPPI)
- Elandsrand Gold Mine.

The partners in the project were:

- Energy Research Institute, University of Cape Town
- The European Commission
- ETSU, the UK Energy Efficiency Agency
- Novem, the Netherlands Energy Efficiency Agency

The output from this project included seven guide books, covering the topics of:

- The 3-E Strategy (Energy, Efficiency, Earnings)
- Boilers and Furnaces
- Compressed Air Systems
- Refrigeration
- Steam Systems
- Insulation
- Electrical Systems.

The findings were also disseminated via national workshops, and the guidebooks are available on compact disc as well as on the 3E website, www.3e.uct.ac.za. This web-site also contains a database of suppliers of energy efficiency equipment and services.

As a result of the success of this project, plans are being made to expand this work into other African countries, while in South Africa, the Energy Research Institute is actively seeking assistance to initiate a benchmarking exercise within selected sectors of local industry.

South Africa – What is happening now?

A recent initiative in the area of energy efficiency in South Africa is the provision of compact fluorescent lamps (CFL's). These lamps use 75% less electricity than conventional incandescent light bulbs and last up to ten times longer.

Bonesa, a joint venture initiative between Eskom, Africon Engineering International and Umongi-Karebo, established to market CFL's, aims to penetrate the South African market with 31,5 million bulbs in the next decade and a half.

The South African government is also currently involved with large-scale low-cost housing projects, providing an ideal opportunity to install these CFL's in the newly-built houses.

A number of education programmes are on offer to increase awareness around energy efficiency. Two examples include the certification of energy engineers and the postgraduate programme in sustainable energy engineering, offered at the University of Cape Town.

An exciting development is the entry of Eskom into another area related to energy efficiency, namely demand-side management. One may wonder why the largest electricity utility in Africa should be worried about measures to use energy efficiently. It must be appreciated that Eskom is more concerned about shifting load from peak periods than using less electricity. This development stems from the current situation within the South African electricity supply industry. The government wishes to privatise Eskom by 2004, converting it to a limited liability company with transmission, distribution and generation split into separate corporate entities. The intention is also to introduce private sector participation in generation through strategic equity partnerships or public share offerings in conjunction with the introduction of independent power producers.

Faced with this, plus predictions that current installed capacity will not meet the projected demand in 2007, Eskom has had to face some tough choices. Should it continue to invest in power stations, given their uncertain position in a privatised electricity industry? If they did invest, what type of plant should be installed? There is no shortage of base load stations, but there is a shortage of peaking plant. Will there be environmental objections to additional gas-turbine or pumped-storage capacity?

Faced with these choices, it is of little surprise that Eskom has looked at the other option, namely to manage the demand. The intention is that, using a combination of negotiated load interruption and load management, the 2007 deadline can be shifted out to somewhere between 2015 and 2025.

Eskom has already demonstrated the feasibility of managed interruption. Currently, 10 000 domestic electric water heaters in Cape Town are individually controlled from Johannesburg, some 1 500km distant. Eskom is offering these consumers 40 different control regimes, where the consumer chooses the most convenient time to have the supply to the water heater interrupted.

In order to achieve its goal, Eskom needs to identify loads of a significant size that can either be shifted or interrupted. Additionally, a monitoring and verification (M&V) plan will be required to ensure that the savings are achieved. The M&V plan is important, since while Eskom will fund equipment to achieve the savings, they would want users to repay them a percentage of the savings achieved.

Barriers to Implementation

The largest single barrier to the implementation of energy efficiency initiatives is undoubtedly mind-set. Besides the traditional barriers that were discussed briefly above, a peculiar African problem relates to the state of the continent. When one considers the health, education and poverty challenges facing the continent, it is sometimes argued that energy is the least out our problems. On the other hand, it should be argued that energy is an essential part of the solution to these problems. Without reliable and affordable energy supplies, it will be almost impossible to eradicate these problems and improve the quality of life in Africa.

Energy efficiency also suffers when no-one takes ownership. Governments and industrialists may pay lip service to the concept, but unless resources are available in the form of a clearly-identified and well-advertised agencies or interest groups, those wishing to know more do not know where to turn.

There is sometimes suspicion of the motives of consultants, especially those funded by international agencies. Africa has many examples of foreign-funded projects that have achieved little more than to fund the manufacturing sector of the donor country. Inappropriate solutions to energy problems, with little or no back-up after installation, can be found abandoned in most African countries. Who is to say therefore, that energy efficiency is not just another way of importing yet more inappropriate equipment?

Overcoming Implementation Barriers

Energy efficiency makes economic sense. Very often, payback periods of less than 1 year are achievable. This message must reach policy makers, industrialist and individuals.

Education is one key. Education is required in the form of dissemination of relevant examples, to build capacity in the area of energy auditing and by means of awareness campaigns.

Incentives provide an intriguing option, to show users that those proposing

energy efficiency measures requiring capital investment have faith in their promises. The incentive could include repayment of the capital investment out of a portion of the savings. In this way, the risk is not carried by the user, who may have found it difficult to raise the capital anyway.

Benchmarking is another approach to engender interest in energy conservation. Industrialists must be convinced that a comparison of their specific energy requirements with local and international competitors will indicate how efficient and hence how competitive they are operating. This evidence can be sufficient to convince senior management of the benefits of embarking on energy efficient measures. The hurdle is to obtain the data from the companies, who fear that this will somehow give an advantage to the competition. However the data is always presented to preserve the anonymity of the participants, so these fears are without foundation.

Proposals and Recommendations

There is the interest and a wide range of skills in the field of energy efficiency available in Africa. This workshop attests to that fact. It would be to the advantage of all that these skills were used optimally. There are a number of aspects to this, some of which are noted below.

- **Information Sharing.** The work that has been already been undertaken in this field in Africa needs to be disseminated across the whole region/continent.
- **Skill sharing.** In a continent with a shortage of technical skills, it makes sense to share these skills across national borders.
- **Creation of a Resource Base.** With the availability of increasingly reliable electronic data exchange, an electronic data base, with particular relevance would provide a valuable tool to assist energy efficiency engineers across the continent.
- **Training.** The importance of capacity building in this area cannot be overstressed.
- **An African Energy Efficiency Association.** Improved communications within Africa mean that a "virtual" Energy Efficiency Association is a viable option. Such an association would be able to co-ordinate the activities mentioned above, as well as take responsibility for continuing the work of the present meeting.