DEPARTMENT OF ENVIRONMENTAL AFFAIRS AND TOURISM

SOUTH AFRICA

COUNTRY REPORT

FOURTEENTH SESSION OF THE UNITED NATIONS COMMISSION ON SUSTAINABLE DEVELOPMENT

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List of Acronyms

AGOA	Africa Growth and Opportunity Act
APINA	Air Pollution Information Network for Africa
AQA	Air Quality Act
AQMP	Air quality management plan
AU	African Union
BCI	Business Confidence Index
BEE	Black Economic Empowerment
BFP	Basic Fuels Price
BNM	Basa Njengo Magogo alternative fire lighting method
BPO	Business process outsourcing
CABEERE	Capacity Building in Energy Efficiency and Renewable Energy
CAPCO	Chief Air Pollution Control Officer
CAPEX	Capital Expenditure Programme
CBO's	Community based organisations
CCP	Cities for Climate Protection
CDM	Clean Development Mechanism
CERS	Certified Emission Reductions
CEF	Central Energy Fund
CFC's	Chlorofluorocarbons
CFL's	Compact fluorescent lights
CO	carbon monoxide
CONNEP	Consultative National Environmental Policy Process
CIF	Critical Infrastructure Fund
CP	Cleaner Production
CSD	Commission on Sustainable Development
CSIR	Council for Scientific and Industrial Research
DBSA	Development Bank of Southern Africa
DEAT	Department of Environment and Tourism
DoH	Department of Housing
DME	Department of Minerals and Energy
DNA	Designated National Authority office
DSM	Demand Side Management
The dti	Department of Trade and Industry
ECA	Economic Commission for Africa
EDI	Electricity Distribution Industry
EDRC	Energy and Development Research Centre
EMIA	Export Marketing and Investment Assistance
EMM	Ekurhuleni Metropolitan Municipality
EIA	Environmental Impact Assessment
EU	European Union
FNB	First National Bank
GATT	General Agreement on Tariffs and Trade
GCCC	Government Committee on Climate Change
GDP	Gross Domestic Product
GEF	Global Environment Facility
GODISA	Programme to stimulate technology transfer.
GTZ	German Technical Co-operation Organization
GVEP	Global Village Energy Partnership

GWh	Giga Watt Hours
ICLEI	International Council for Local Environmental Initiatives
ICT	Information and communications technologies
IP	Illuminating paraffin
IDC	Industrial Development Corporation
IeC	Integrated Energy Centre
IP&WM	Integrated Pollution and Waste Management Policy
JSE	Johannesburg Stock Exchange
LRP	Lead Replacement Petrol
LPG	Liquefied Petroleum Gas
MEC	Member of the Executive Council
MFRC	Micro Finance Regulatory Council
Mtoe	Million tonnes of oil equivalent
MW	Mega Watt
NAAMSA	National Association of Automobile Manufacturers of South Africa
NAQMP	National Air Quality Management Programme
NCCC	National committee on Climate Change
NCPC	National Cleaner Production Centre – South Africa
NEDLAC	National Economic Development and Labour Council
NELF	National Electrification Forum
NEMA	National Environmental Management Act (Act No. 107 of 1998)
NEPAD	New Partnership for Africa's Development
NER	National Electricity Regulator
NERI	National Energy Research Institute
NERSA	South African National Energy Regulator
NGO	Non-governmental organisation
NLR	National Loans Register
NSI	National System of Innovation
NTTC	National Technology Transfer Centre
OAU	Organisation of African Unity
PBMR	Pebble-bed modular reactor
PFMA	Public Finance Management Act
ProBEC	Program for Biomass Energy Conservation in Southern Africa
PUC	Productive Use Container
R&D	Research and Development
RDP	Reconstruction and Development Programme
REDs	Regional Electricity Distributors
SA	South Africa
SACEF	South African Competition Economics Forum
SACN	South African Cities Network
SACOB	South African Council of Business
SADC	Southern African Development Community
SALGA	South African Local Government Association
SANS	South African National Standards
Sapia	South African Petroleum Industry Association
SAPP	Southern African Power Pool
SARS	South African Revenue Services
SEA	Sustainable Energy Africa
SET	Science, Engineering and Technology
SETAS	Sector Education and Training Authorities

SEDA	Small Enterprise Development Agency
SEI	Stockholm Environment Institute
SETA	Skills Education & Training Authorities
STEM	Short-term energy market
Sida	Swedish International Development Cooperation Agency
SIP	Strategic Industrial Projects
SMEDP	Small and Medium Development Programme
SMMDP	Small and Medium Manufacturing Development Programme
SME	Small and medium enterprises
SMME	Small, medium and micro enterprises
SPII	Support Programme for Industrial Innovation
SSA	Sub-saharan Africa
TAU	Technical and Administrative Unit
THS	Tax holiday scheme
THRIP	Technology and Human Resources for Industry Programme
TIASA	Thermal Insulation Association
TMM	Tshwane Metropolitan Municipality
TSP	Technology Stations Programme
TWIB	Technology for Women in Business
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	UN Framework Convention on Climate Change
UNIDO	United Nations Development Organisation
USA	United States of America
VAT	Value added tax
W	Watt
WOESA	Women in Oil and Energy
WTO	World Trade Organisation
WINSA	Women in Nuclear

Introduction

The United Nations Commission on Sustainable Development (CSD) was created in to ensure effective follow-up of the United Nations Conference on Environment and Development (UNCED) ; to monitor and report on implementation of the Earth Summit agreements at the local, national, regional and international levels. The mandate of the commission was reaffirmed by the World Summit on Sustainable Development held in Johannesburg in 2002

At its eleventh session, the Commission on Sustainable Development decided that its multi-year programme of work beyond 2003 would be organized on the basis of two-year cycles, with each cycle focusing on selected thematic clusters of issues. CSD 11 further encouraged countries to provide national reports, on a voluntary basis, for every review session on the thematic clusters of issues reflecting the overall progress, trends and emerging issues as well as constraints and challenges. The CSD also invited the Secretariat of the Commission to improve on reporting guidelines and questionnaires with the intention of making reporting more efficient and less cumbersome on countries and more focused on implementation.

The United Nations Division for Economic and Social Affairs (UNDESA) has requested national focal points to submit country reports as a contribution to the Secretary General's Report for CSD 14, which focuses on the thematic cluster of Industrial Development, Climate Change Air Pollution/Atmosphere and Energy for Sustainable Development

This report is the South African country report to the Commission, which reports on the progress made in the implementation of Agenda 21 with regard to the review, evaluation and monitoring processes. It specifically focuses Industrial Development, Climate Change Air Pollution/Atmosphere and Energy for Sustainable Development. The key elements of the CSD-12 Report include a reflection on lessons learnt, best practice, the identification of actions, opportunities and constraints to the implementation of sustainable development and to the formulation of the NSDS.

This report was developed through a rigorous intergovernmental process coordinated by the Department of Environmental Affairs and Tourism with the support of the department of Trade and Industry, the Department of Foreign Affairs, the Department of Mineral and Energy and the Department of Health. The development of the report included consultations and numerous written submissions from representatives of major groups, organised business and labour. This report is globally applicable within a national and even a local context and it was developed through a methodology that does not simply comply with the request from the United Nations but with and to strengthen the Sustainable Development Agenda in South Africa.

I. Overview

1. Energy

1.1 *Concrete actions taken and progress made in implementation*

Energy efficiency

Energy efficiency was introduced in all sectors of energy consumption, as specified in the Energy Efficiency Strategy of South Africa. The strategy sets a national target for energy efficiency of 12% by 2015. Through a historic Energy Accord between industry, mining and the Government, industry players committed to a voluntary target of final energy demand reduction of 15%. An appliance-labelling programme was launched for domestic appliances such as refrigerators and further sectors will be targeted, such as transportation.

Renewable energy

A renewable energy policy outlining a voluntary target of 10 000 GWh renewable energy contribution to final energy consumption by 2013 to be produced mainly from biomass, wind, solar and small-scale hydro, bio-fuels etc. (both power generation & non power generation technologies) was released. This is equivalent to approximately 4% of projected electricity demand by 2013. Since the Cabinet approval of the renewable energy policy, 90 GWh have been implemented towards the target. The Designated National Authority (DNA) was established within the Department of Minerals and Energy and a total of 7 projects have been submitted for approval.

Electricity

Due to our growing energy needs, new generation capacity will be required by end of 2008. A process to call for bids to build the new power station has commenced. The Integrated National Electrification Programme is on track and reached a target and connected the 7.5 millionth households to the national grid. This was an achievement of 4 million new household electricity connections since 1994. DME states that universal access to electricity will be achieved, within the envisaged 8-year time frame. As one of the Government's poverty alleviation initiatives, a pilot study commenced in 2002 to inform the free basic electricity (FBE) policy to determine the most effective and financially viable delivery process. To date, about 490 000 households are receiving FBE through Eskom (the national electricity utility) and municipalities.

The Integrated Energy Centres (IeC's) Programme, established in 2002 as contribution to the Integrated Sustainable Rural Development Programme is considered an appropriate mechanism for delivering affordable, modern and safe energy, particularly to low-income communities in remote areas. Three IeC's have been established to date.

Research

Cabinet approved the establishment of National Energy Research Institute (NERI), which will be jointly coordinated between the DME and Department of Science and Technology and will conduct research and innovation in the energy sector. The Central Energy Fund (CEF) has been restructured to ensure that it plays a greater role in the development and promotion of renewable energy sources and technologies as well as host NERI.

Key future objectives of energy

- Promote integrated planning across all spheres of Government;
- Incorporate lesson learned from Integrated Development Plans (IDP's) and local government experience with sustainable development into the Integrated Energy Planning process;
- Address energy poverty;
- Address income generation opportunities;
- Focus initiatives on climate change;
- Strengthen capacity in Government;
- Build alliance and foster collaboration amongst regions;
- Address restrictive trade barriers and subsidies in developed economies to reduce constraints on renewable energy product imports; and
- Address issues around ongoing dependency on fossil fuels and coal in particular.

2.2 *Constraints and challenges*

- General: Lack of knowledge and expertise in Government as well as lack of adequate funding from National Treasury to achieve real impacts;
- Lack of funding and capacity is causing a gap between policies, goals and targets and implementation;
- Integrated Energy Planning is not adequately implemented;
- The low price of electricity is a serious barrier to the introduction of energy efficiency measures as well as the competitiveness of energy from renewable sources;
- In terms of cleaner fuels: The potential to displace Illuminating Paraffin (IP) as a household fuel with cleaner fuels such as LPG and bio-ethanol gel;
- The lack of full cost accounting and perverse incentives (such as the VAT zero rating of IP) hampers the growth of cleaner fuels and technologies;
- Basic energy subsidies don't reach the poorest of the poor;
- In terms of renewable energy: Lack of adequate funding to achieve targets;
- In terms of energy efficiency: Lack of adequate incentives from Government and the absence of regulatory measures;
- In terms of transport: A lack of co-ordination between town planning and an integrated approach to sustainable urban settlements hampers the introduction of efficient transport measures.

B. Energy

B.1 Strategies, policies, programmes and the regulatory framework

1. 1Legal and regulatory frameworks related to energy policies

1.1.1 The Constitution

The Constitution (1996) provides the legal basis for allocating powers to different spheres of Government and contains a number of rights specifically relevant to energy policy. The Constitution states that Government must establish a national energy policy to ensure that national energy resources are adequately tapped and delivered to cater for the needs of the nation. Energy should be made available and affordable to all citizens, irrespective of geographic location. The production and distribution of energy should be sustainable and lead to an improvement in the standard of living of citizens.

The Bill of Rights provides that:

"Everyone has the right:

- *to an environment that is not harmful to their health or well-being; and*
- *to have the environment protected, for the benefit of present and future generations through reasonable legislative and other measures -*
- *prevent pollution and ecological degradation;*
- *promote conservation; and*
- *secure ecologically sustainable development and the use of natural resources while promoting justifiable economic and social development."*

In order to meet the Government's obligations in this regard, the White Paper on Energy Policy (1998) states that:

"Government will work towards the establishment and acceptance of broad targets for the reduction of energy related emissions that are harmful to the environment and to human health".

1.1.2 The White Paper on energy policy for South Africa

South Africa's energy policy in the past focused heavily on issues of security of energy supply and self-reliance. With the publication of the White Paper on Energy (1998), more focus was placed on ensuring adequate supply to a large section of the population that had been largely ignored in previous policies. The White Paper on Energy (1998) identifies 5 overarching national energy policy objectives:

- Increased access to affordable energy services: Government will promote access to affordable, adequate and secure energy services for disadvantaged households, small business, small farms and community services;
- Improved governance of the energy sector to achieve greater integration in energy policy development and energy services delivery;
- Stimulating economic development by encouraging fair competition within energy markets by means of targeted interventions through appropriate mechanisms;

- Management of energy related environmental impacts by promoting access to basic energy services for poor households to ameliorate negative health impacts arising from the use of certain fuels and establishing broad national targets for the reduction of harmful energy-related emissions; and
- Pursuing energy supply security through greater diversification, both in supply sources and primary energy carriers. This implies, amongst others, increasing the regional integration of energy resources, systems, skills and technologies within Southern African Development Community (SADC) through mechanisms such as the Southern African Power Pool and the facilitation on inter regional trade in energy.

1.1.3 Energy Efficiency Strategy of the Republic of South Africa

This is the first Energy Efficiency Strategy for South Africa. It is the first consolidated Governmental document geared towards the development and implementation of energy efficiency practices in this country. The Strategy takes its mandate from the *White Paper on Energy Policy*, published in 1998, and links energy sector development with national socio-economic development plans as well as being in line with other Government departmental initiatives. In addition, it provides clear and practical guidelines for the implementation of efficient practices within our economy, including the setting of governance structures for activity development, promotion and coordination.

This Strategy allows for the immediate implementation of low-cost and no-cost interventions, as well as those higher-cost measures with short payback periods. These will be followed by medium-term and longer-term investment opportunities in energy efficiency. The Strategy acknowledges that there exists significant potential for energy efficiency improvements across all sectors of our national economy. The vision of the Strategy is to contribute towards affordable energy for all, and to minimise the negative effects of energy usage upon human health and the environment. This will be achieved by encouraging sustainable energy development and energy use through efficient practices. The three cornerstones of sustainable development are embraced within the strategic goals of this document, these being environmental, social and economic sustainability.

The Strategy sets a national target for energy efficiency improvement of 12% by 2015. This target is expressed in relation to the forecast national energy demand at that time, and therefore allows for current expectations of economic growth. It is accepted that this target will be challenging, but at the same time it is considered to be readily achievable through the means described within the following pages.
Energy efficiency improvements will be achieved largely via enabling instruments and interventions. These will include *inter alia* economic and legislative means, efficiency labels and performance standards, energy management activities and energy audits, as well as the promotion of efficient practices.

The Strategy will cover all energy-using sectors and will be implemented through Sectoral Implementation Plans as outlined within. Systems will be put into place in order to periodically monitor progress against the target that will be reviewed at the end of each phase.

1.1.4 The White Paper on Renewable Energy

The South African Government has committed to a specific target for the role that renewable energy will play in the energy generation mix in South Africa. The target is documented in The White Paper on Renewable Energy, approved by Cabinet in November 2003. The target states that:

> *"10 000 GWh (0.8 Mtoe) renewable energy contribution to final energy consumption by 2013, to be produced mainly from biomass, solar and small-scale hydro. The renewable energy is to be utilised for power generation and non-electric technologies such as solar water heating and biofuels".*

The target will be achieved by utilising a mix of different renewable energy resources and applications and the selection of the RE applications will be based on the least-cost principle. It is noted that the target corresponds to approximately 5% of the present total annual electricity generation.

The target will be implemented in three phases during the 2004 - 2013 period and the renewable energy strategy will need to be monitored on a periodic basis to determine the effectiveness of the measures and technologies employed to meet the overall target of 10 000 GWh. An effective monitoring model therefore, needs to be developed, installed and used. The project proposal developed in response to the invitation to tender relates to the development of a methodology for a monitoring process for the implementation of the renewable energy strategy and training of DME staff to implement the new data monitoring and tracking system.

1.1.5 Renewable Energy Strategy

A draft renewable energy strategy was prepared to elaborate on the White Paper Renewable Energy. The DME has begun a process to look at the rules for a renewable energy market by establishing a pilot project to address the various aspects, including uncertainties, related to green power markets. Eskom conducted a number of pilot projects to assess issues related to the green power market in South Africa.

Eskom's research and development of clean coal technologies and renewable energy technologies demonstrates commitment to and support for this key energy text of the Johannesburg Plan of Implementation. This is enhanced by Eskom's Integrated Strategic Electricity Planning (ISEP) process with the objective to optimise the supply-side and demand-side mix, while factoring in environmental concerns. Eskom's current energy mix is largely coal based and will continue to be so for the foreseeable future. However, Eskom is committed to investigate and evaluate options for the diversification of the energy mix over time with, amongst others, renewable energies with a view to reduce the reliance on coal, in keeping with Government policy.

Therefore, for the past ten years, Eskom Research, Development and Demonstration has been involved in research of new and innovative technologies. A specific research programme was developed covering both the bulk supply of renewable energy as well as rural and off-grid applications (detailed below). Although this topic is being researched throughout the world,

specific, focused research with respect to new technologies as well as the adaptation or evaluation of existing technologies for specific South African conditions was required.

Wind

The wind energy demonstration facility is situated at Klipheuwel in the Western Cape. The three wind turbines produced a total of 9,826 GWh since the commissioning of the first wind turbine in 2002. The turbines delivered an availability of between 89,78% and 94,63% during 2004, with an energy use factor of between 13,32% and 15,89%. The relatively low energy use factor is determined by the prevalence of wind.

Solar

The solar dish stirling system, commissioned in August 2002, sent out a total net energy of 6 438 kWh in 2004. The low output of energy was as a result of system unavailability, changes and modifications made as part of the research programme. The system was damaged in October 2004 and no electricity was generated for the rest of the reporting period. The research and demonstration has confirmed that the dish is not yet a commercially viable option.

Biomass

Eskom is planning to pilot a biomass gasification technology in the Eastern Cape. Initial discussions started with the affected community and the University of Fort Hare in 2003. The energy produced from the gasifier will be utilised for development within the community around a sawmill. It is projected that the system will generate 100 kW of energy.

Ocean energy

Eskom is investigating the feasibility of using ocean energy as a future primary energy source. A resource assessment of the wave and tidal power density along the South African coastline continued in 2004. The study is aimed at assessing international technologies and determining which technology to implement in South Africa.

Fuel cell

Eskom and the University of the Western Cape have for the past three years collaborated on local fuel cell research. This research was mainly aimed at the development of skills in terms of this technology. The prototype 50 W battery charger is currently under development and the aim is for the first demonstration model of the device to be completed by the end of 2005.

1.1.6 Energy Bill

The Cabinet has approved the release of a draft National Energy Bill for public comment. The Bill will establish the National Energy Act, 2004 and will come into operation on a date determined by the President by proclamation in the Gazette.

A White Paper on Energy Policy was approved by Cabinet in 1998. Since then, a number of policies have been implemented through Acts promulgated and Bills currently in preparation. These Acts and Bills include:

- Nuclear Energy Act (1999) No 46 of 1999;
- National Nuclear Regulatory Act, 1999 (Act no. 47 of 1999);

- Gas Act, 2001 (Act No. 48 of 2001);
- Petroleum Products Amendment Act 2003;
- Petroleum Products Amendment Act 2004;
- Petroleum Pipelines Act 2003
- Petroleum Pipelines Money Act;
- Electricity Supply Industry Regulatory Bill;
- Electricity Supply Industry Restructuring Money Bill;
- Electricity Distribution Industry Restructuring Bill;
- Electricity Distribution Industry Restructuring Money Bill
- National Energy Regulator Act, 2004;

The White Paper on Renewable Energy (2004) was approved by Cabinet.

The purpose of the Energy Act is to address those energy policies not already implemented through the above Acts and Bills.

The content of the Energy Bill addresses:

- The establishment of a National Energy Advisory Committee to advise the Minister one energy policy matters;
- The establishment of a National energy Data Base and Information system, providing for mandatory collection of energy data by the Department of Minerals and Energy;
- The establishment of an Integrated Energy Planning capability;
- The establishment of a Renewable Energy Programme;
- The establishment of an Energy Efficiency Programme;
- The establishment of an Energy, Safety, Health and Environment Programme not provided for in another legislation;
- The establishment of a Programme to address the access of energy to households;
- The provision for the fulfilment of international commitments and obligations pertaining to energy;
- The establishment of a national energy research programme. This provision will provide for sustainable energy supply through national directed research and development. Such research and development is currently fragmented and insufficient for future national development needs.

1.2 Access to electricity and other energy services

1.2.1 Electrification

A concerted effort to extend the electricity grid to the majority of people in South Africa began in 1991. The National Electrification Forum (NELF), which was formed thereafter, developed a range of scenarios for the national electrification programme. Through the Reconstruction and Development Programme (RDP), the newly elected government in 1994 confirmed its commitment to increase access to electricity to previously disadvantaged communities. The target of 2.5 million homes by the year 2000 was exceeded (2.8 million new households were connected) and the national household electrification level has increased from 36 percent in 1996

to about 71% in 2004.

The electrification programme has resulted in significant increases in peak demand even at relatively low levels of consumption, with far-reaching implications for future generation and new peaking capacity may be required by 2007 (Espinheira, 2003) even at relatively low levels of consumption.

Eskom's Integrated Strategic Electricity Planning (ISEP) process provides strategic projections of supply-side and demand-side options to be implemented to meet long-term load forecasts. It provides the framework for Eskom to investigate a wide range of new supply-side and demand-side technologies, with a view to optimising investments and returns. The most recent ISEP plan (ISEP9a) was approved early in 2004 and provides economically and environmentally acceptable options for flexible and timely decision-making. The focus has been to provide a robust plan, taking into account Eskom's and the shareholder's objectives.

Eskom continues to investigate a variety of options, including conventional pulverised fuel plants, pumped storage schemes, gas-fired plants, nuclear plants (PBMR), greenfield fluidised bed combustion technologies, renewable energy technologies (mainly wind and solar projects) as well as import options. Government has recently taken the decision that Eskom will build approximately 70% of the new capacity required in South Africa. The balance is expected to come from independent power producers (IPPs). It is likely that Eskom will be the counterparty in the power purchase agreements with these IPPs.

Non-grid electrification in South Africa

The use of renewable energy is playing a key part in government's ongoing R1,2-billion-a-year electrification drive, aimed at providing all households in South Africa with electricity. The National Electricity Regulator (NER) is involved with the pilot phases of two renewable-energy programmes, focusing on non-grid electrification projects and hybrid mini-grid systems According to the non-grid programme, six rural concession areas were identified in non-grid electrification areas. Prospective companies were invited to submit proposals, and from this a group of six concessionaires were appointed in the middle of 2001 to undertake non-grid electrification projects. Following a longer than expected period to negotiate the contracts the concessionaires started to operate at the beginning of 2002. Since then, one concessionaire has withdrawn from its non-grid business intentions, and another has not managed to become fully operational. Four concessionaires are currently providing solar home systems (SHS) in four of the areas.

The "fee-for-service" model is employed in South Africa where non-grid service providers or concessionaires are supplying electricity to customers in a specific concession area. The electricity is still supplied through SHS but the household does not own the equipment and only pay a service fee per month. Responsibility for operating and maintaining the equipment therefore rests with the service provider and the household enjoy the service at set a cost per month. The system provides enough electricity for four lights, a radio, a black and white TV and the facility to charge a cell phone battery.

1.2.2 Integrated Energy Centres

The Department of Minerals and Energy (DME) initiated the Integrated Energy Centre (IeC) Programme in 2002/01 as part of its contribution to Integrated Sustainable Rural Development Programme in support of the Government strategy on service delivery and poverty eradication. The programme targets the nodal poverty areas as identified by the State President. These are at the heart of the government's policies for improving household energy supplies in South Africa. Hence DME has recently established three pilot regional energy offices (in Limpopo, Kwazulu Natal and Eastern cape) to expedite the delivery of energy services to rural areas.

There are currently three IeCs namely Kgalagadi IeC near Kuruman (Northern Cape), Eshane IeC near Greytown (Kwa-Zulu Natal) and Caba Mdeni near Matatiele (Eastern Cape), and the DME is preparing a strategy to roll out more centres. These Centres are to be established as co-operatives of the local community and will provide a sales outlet for energy products such as petrol, diesel, paraffin, gas, energy efficient appliances and so on. Also, the IeC will be a source of energy information dissemination .in rural communities. Underlying this is a strong social responsibility aimed at poverty alleviation, job creation and capacity building. Indeed the communities around IeCs are benefiting from the programme in that:

- Energy sources such as paraffin, LPG gas, petrol and diesel, lubricants and other petroleum products are now available closer to the communities
- Energy products and gadgets such as Efficient Bulbs, Eskom pre-paid cards, solar cookers etc are also available at the centre
- Information on energy in general (including Free Basic Electricity) is provided by Information Officers at the IeC
- Training on paraffin and LPG gas safety

The IeC programme is supported by Total SA and Sasol, and there are other stakeholders such as National Development Agency, Eskom Rural Development etc. that are also involved.

1.2.3 The South African Global Village Energy Partnership project

The *Global Village Energy Partnership*, GVEP, launched by UNDP and the World Bank at the World Summit on Sustainable Development in 2002, is a 10-year implementation-based programme currently active in more than 17 countries in Africa, Latin America and Asia. Motivated by the situation of nearly 2 billion people worldwide who do not have access to modern energy, or who cannot afford this, it aims to positively *influence energy-poverty* in over 30 countries, and to contribute to 400 million people having access to modern energy.

GVEP's approach to accelerate the pace and scope of energy activities in a more coordinated fashion and to improve access to energy services for the poor on a scale that has never been done before, is to form *partnerships* that bring together all interested stakeholders, including governments, donor organisations, private firms, consumer groups, NGOs, and the financial community. It works to catalyse country commitments to village energy programmes, to bridge the gap between investors, entrepreneurs and energy users, to facilitate appropriate policy and market regulatory frameworks, to serve as a marketplace for information and best practices, and to create and maintain effective coordination mechanisms to meet the needs of the target communities. Uniquely, it *acts across these needs*, also taking cognisance of non-energy areas

of poverty, and, therefore, contributes to the achievement of the Millennium Development Goals, and supports sustainable development. It currently has more than 425 partners worldwide.
South African Focus

1.3 Efficient use of energy

1.3.1 Demand-side management in South Africa

Eskom (the national electricity utility) is implementing demand side management (DSM) in South Africa through collaboration with DME and NER. The following policy documents inform the DSM programme:

- The DME's White Paper on Energy Policy
- DME's Energy Efficiency Strategy
- NER's Energy Efficiency and Demand Side Management Policy

South Africa is among a few countries in the world that have set comprehensive targets for energy efficiency improvements. A summary of energy efficiency targets is provided in section 6. Legal and regulatory frameworks related to energy policies.

South Africa's electricity supplies are largely generated from coal-fired power stations, consuming large quantities of coal and emitting greenhouse gases. South Africa's economic growth has driven peak demand of electricity to rise at 15 percent per year. By 2007, peak-period demand of electricity will exceed Eskom's ability to supply electricity during these periods and by 2010 additional base load capacity will be required. DSM aims to save 4 255MW over a period of 20 years - this equates to the generating capacity of one six-pack power stations.

DSM refers to collaborative programmes aimed at reducing electricity demand through encouraging efficient use, particularly at peak periods. Eskom's DSM strategy comprises a dual approach: to reduce electricity demand at peak periods (07:00 - 10:00 and 18:00-20:00) by shifting load to off-peak periods and by overall electricity consumption reduction through the installation of energy efficient equipment and optimising processes. Sustainable DSM projects often involve a combination of both methods. For commercial and industrial clients, energy audits are undertaken to establish potential savings and the installation of energy efficient equipment. For example, First National Bank is saving R2,2 million per year on electricity following a lighting and air conditioning retrofitting project.

1.3.2 Introduction of energy efficient lighting

The 1999 launch of the local efficient lighting initiative called Bonesa was one of the first DSM activities in South Africa. This was jointly funded by the Global Environment Facility and Eskom over a period of 3 years. Now the use of compact fluorescent lamps (CFLs) through customer education, advertising and marketing is being promoted. Eskom DSM reported that CFL's represented 32 percent or 64 MW of the total MW savings for 2004 (Holtzhausen, 2005). The price of CFL's dropped from between R60-R80 (1996) to R13-R20 (2004) due to joint sales promotions with local suppliers and increased volumes of CFL's.

1.3.3 Awareness raising on energy efficiency

During energy efficiency month in 2005, Government signed an agreement with Industry in which large industrial role-players agreed to work together with Government in working towards the energy efficient targets. This is a voluntary Accord, in line with Government's strategy to use voluntary mechanisms wherever possible.

Eskom DSM Schools Programme

Eskom DSM launched the first outcomes based education energy efficiency school programme in September 2002 in Johannesburg. Known as the "Counting the Cost of Energy" programme, teachers are supported in integrating environmental themes with their curricula, especially in the natural sciences and technology subjects. The programme provides learners with critical knowledge to manage their own electricity use wisely, thereby reducing costs to their households and minimising environmental impacts. Counting the Cost of Energy was developed in accordance with Curriculum 2005 and was piloted in 30 Gauteng schools prior to the regional roll-out of 700 schools in Gauteng during 2003 and the national roll-out in 2004. An interactive industrial theatre programme has been devised to introduce the Eskom DSM school programme to 25 schools in the Western Cape, Eastern Cape, North West, Mpumalanga and Gauteng.

Marketing and Awareness

An integrated marketing and communication strategy was developed in support of the DSM objective of saving 153 MW annually and to enhance DSM's overall marketing and public awareness campaigns. The strategy consisted of diverse programmes including Energy Efficiency Month and the Power Play TV game.

1.3.4 Introduction of improved cook stoves

Energy efficient cooking devices

The Department of Minerals and Energy (DME) and GTZ (German Technical Co-operation organization) have been collaborating on an extensive field trail testing the social acceptability of 7 different models of solar cookers since 1996. Positive results, both in terms of acceptance by the target group as well as potential impacts on fuel savings, time savings and emission reductions lead to the second phase of the project, namely local production and distribution of solar stoves. Unfortunately commercial production could not be justified and the project will close at the end of 2005.

The solar cookers are now presented as part of a renewable cooking appliance bundle, including a solar stove, a fuel-efficient wood or coal stove and a heat retained cooker, the HotBag. .

Current appliances available, which can be considered to be energy efficient, are the following:

The *Sunstove* is a box solar cooker with a blow-moulded polyester casing. It is suitable for small families and low temperature cooking. It sells for R200, and there is an option to

purchase black cooking pots for use with the cooker. About 10 000 units have been sold to date in South Africa as well as other African countries.

The second box-type cooker is called the *Suncather*, produced in KwaZulu/Natal. The Suncatcher is provided with a school training module, making it an ideal teachers aid and demonstration resource. The cooker and education pack sells for R120.00

Two parabolic-type solar cookers (the K14 and K10 models) are distributed by the company Rapid Dawn. The cookers are available for R700 and R1000 respectively.

Lastly, there are the retained heat cooker options:

- There is the which retains heat for 3-5 hours, and saves 75 percent of cooking fuel costs;
- The *Hotbox* concept, which costs R120 excluding VAT.; and
- The *Wonderbox* is produced in Cape Town and sells for R50.
-

Although solar cookers and the Hotbag remains available as commercial products in the market to consumers, sales have remained low and indications are that there exists only a niche market for these products. However, affordability and end-user credit remain important issues and since no end-user credit was extended during the project in a market segment that does virtually no large purchases without credit, the question still remains that if consumer credit can be offered, if sales will increase.

For more information on renewable energy cooking devices, see www.solarcookers.co.za

1.3.5 The Program for Biomass Energy Conservation in Southern Africa (ProBEC)

This programme has the vision to satisfy lower income population groups' energy requirement in a socially and environmentally sustainable manner. It is estimated that biomass will remain the primary source of basic energy for up to 80% of total energy consumption for families and small businesses in most southern African countries. Thus it is important that the available energy is being used in an environmentally sound and socially responsible way. Smoke reduction through BEC measures has been proven to reduce respiratory diseases by 50% for both women and children, reducing child mortality as well. The first implementation phase (1998-2001) has set up national steering committees, regional workshops and information exchange in 6 SADC countries. In addition it included full implementation in Malawi, Mozambique and Namibia, with demo-projects in preparation in Lesotho and South Africa. The second implementation phase is expected to last from 2002 - 2005. Goals include: Further development of Biomass Energy Conservation (BEC) Strategies and promotion at a national level; Promotion of Biomass Energy Conservation measures; Strengthening of biomass energy conservation expertise in the region; and Agreement on the long-term promotion of the program in the SADC region

1.3.6 Introduction of LPG

Manufacturing of LPG occurs at all local refineries, from both crude oil and coal as part of the refining process. LPG is sold and distributed either in bulk or in cylinders along a supply chain. End users of LPG vary cross the spectrum from industrial users to farmers and households

LPG is regarded by energy planners and suppliers as a clean, safe, modern and convenient fuel ideally suited to replace dirty, polluting fuels such as coal and illuminating paraffin (IP) and provide much needed energy for thermal uses such as cooking and space heating. Supporters of LPG argue that it is a suitable fuel, especially in rural areas, but also in areas without modern energy services. Approximately 18 million South Africans are either living in or commuting from rural areas, of which 40 percent of the total population may be defined as rural-based citizens (Hazard and Harris, 2003). It is generally accepted that the provision of modern energy services must include the provision of modern thermal fuels - rural energy provision often focus on the supply of electricity for lighting purposes, but *"poor people don't eat light and they don't cook with electricity (McDade, 2002)"*, they need other energy sources to cook with.

Despite the suitability of LPG to provide clean and safe fuel, end-user perceptions regarding the safety, affordability and accessibility of the fuel remains one of the biggest stumbling blocks in the widespread use of LPG.

Although more than 70 percent of households have access to electricity, this energy source contributes only about 20 percent of household energy consumption. Most energy is obtained from fuel wood (65 percent) with other fuels such as coal, illuminating paraffin and a small amount from LPG making up the remainder (DME, 1998). The reasons for this relate to issues of access and affordability. The affordability and availability of fuels such as LPG and the particular appliances that may be used with LPG, as well as familiarity with and versatility of such alternate fuels, are all factors negatively affecting current LPG use in South Africa. Only 22 percent of LPG produced during 2001 was consumed in the domestic sector:

Higher LPG use in specific regions have been attributed to regional climatic differences, availability of specific fuels in different regions, for example coal, improved accessibility, especially in areas where refineries and depots are situated and higher disposable household income.

Switching from "dirty" fuels such as coal, IP and wood to LPG, could bring considerable health and environmental benefits at local, regional and global levels. Indoor air pollution, which mainly affects women and children, could be significantly reduced. Urban air pollution and emissions of climate-destabilising greenhouse gasses from LPG, calculated on a fuel-cycle basis, are lower than from most other fossil fuels and traditional fuels used in an unsustainable way. By reducing demand for wood and charcoal, switching to LPG can impact positively on deforestation. LPG is safer than other fuels such as IP, although a strong perception still exists in South Africa that LPG is a dangerous fuel.

The environmental benefits of switching to LPG from traditional fuels and most other fossil fuels can be considerable. LPG produces virtually no soot (particulate matter) and relative to most other non-renewable fuels, low emissions of carbon monoxide (CO), unburned hydrocarbons (HC) and oxides of nitrogen (NOx) - the principle precursors of ozone, which produces smog.

There are negligible emissions of toxic gases that can cause health problems when breathed in close to the point of combustion, which makes LPG highly suitable as a household fuel.

Various pilot projects have been launched to address increased access and use of LPG. Details have been provided in section 1.5.

1.3.7 Minimum energy performance standards for appliances and lighting

The average efficiency of electrical domestic appliances currently sold in South Africa is significantly below that of the best products on the market, largely because of customers' and marketers' strong emphasis on first cost at the expense of life-cycle cost considerations, but also because of other barriers such as low energy pricing, lack of awareness and information and lack of appropriate energy efficiency incentives and regulations. An appliance-labelling programme was officially launched by DME in May 2004 as part of the 10-year National Energy Efficiency Strategy.

As part of the implementation of the National Energy Efficiency Strategy, household appliance standards will be updated from the present safety standards to a new system, which also standardises the usage of energy. Mandatory labelling of the household appliances will be promoted and implemented. The household appliance-labelling programme forms part of the residential energy efficiency sector programme. The objective of the residential sector programme to *"achieve a final energy demand reduction of 10% by 2015"*. The outcome of the appliance labelling programme is: *"National best practice standards for energy efficiency are implemented as mandatory and all electrical household appliances are labelled according to the national energy efficiency standards by 2012"*.

1.3.8 Energy efficient building codes

Energy efficient design principles are not solely intended for the low-income housing market, but can and should be applied in all buildings and building activities. However, the biggest benefits can be won by applying energy efficient design principles in low-cost housing delivery. Low-cost houses have been built with no consideration to energy efficient design principles, thereby condemning already poor and suffering households to low-quality, uncomfortable and "costly" houses. Poor households have to spend large amounts of money on fuel for space heating and normally, dirty, polluting fuels such as coal and IP are used. By designing houses in an energy efficient manner, the amount of energy required to keep the house comfortable can be reduced dramatically, thereby saving money as well as improving the air quality inside and outside the house.

The benefits of energy efficient design are (IIEC, 2003):

- Improved comfort of the home all year-round;
- Reduced household space heating requirements in winter, i.e less emissions and smoke inhalation if burning fossil fuels to heat the home;
- Up to 60 percent reduction in electricity use associated with environmentally sound houses in South Africa;
- Reduced energy bills that will allow home-owners to have spare money to pay for services or other priorities;

- Improved health and safety of occupants from reduced indoor smoke and fewer fires from faulty heating and cooking devices;
- Improved air quality of life for residents and communities, and
- Climate change mitigation and emissions reductions.

The White Paper on Energy Policy (DME 1998:77) recognizes that a number of low-income dwellings will be constructed over the coming years but there is serious concern that insufficient attention is being paid to the thermal performance of this low-cost housing. Building without attention to thermal performance may reduce initial costs slightly, but will expose residents to a lifetime of low thermal comfort, high energy costs and cause the high levels of energy related air-pollution encountered in low-cost residential areas to prevail in the future:

"Government will promote energy efficiency awareness in households and will facilitate the establishment of relevant standards and codes of practice for the thermal performance of dwellings, the inclusion thereof in the national building codes, and will promote their implementation through appropriate measures".

With specific reference to the low-cost housing sector the DME has assisted in the development of appropriate guidelines in conjunction with the Department of Housing (DoH) and all other public authorities responsible for housing standards and construction. These guidelines will facilitate minimal lifetime costs and adequate thermal comfort levels. Although both White Papers mention energy efficient housing design, very few measures have been implemented due to cost constraints.

The following standards concerning energy efficient building design are being prepared or already in place:

Table 1: Standards in the building sector

STANDARD	**VOLUNTARY/MANDATORY**	**STATUS**
Commercial Buildings	Voluntary but mandatory with reference to the National Building Regulations	Standard 204 for Artificially ventilated buildings is being drafted by a Sub-Technical Committee. Once finalized DME must request the dti and SABS for the National Building Regulations to be amended. This act will make the standard effectively mandatory for all new office buildings.
Residential Buildings	Mandatory	The Department of Housing is responsible for this standard in conjunction with TIASA. The standard has not been drafted yet.

1.3.9 Efficient use of energy in the commercial sector

The industrial and commercial sector accounts for 77 percent of total electricity demand and the sector is the largest total Eskom market sector category. Base metals, which include ferrous and non ferrous metals, is the largest contributor to electricity demand, followed by the chemicals sector. Base metals account for over 60 percent of direct Eskom supplies to industry and forecasts remain significant for the sub sector up to 2020. The chemicals sector is the next biggest accounting for over 20 percent of Eskom sales to the industrial sector.

The mining sector accounts for 19,5 percent of electricity demand and it is anticipated that it will only increase by 0,5 percent a year over the next 20 years. Trends indicate that mines, especially gold mines are increasingly looking for mining opportunities outside the country and mining's share of total Eskom electricity demand is projected to be 12,9 percent by 2020.

The agricultural sector includes forestry, crop, livestock and other rural electricity supply and accounts for 3,5 percent of electricity demand. Projections indicate very little growth as most farms have been supplied with electricity.

The transport sector demands 3,5 percent of total electricity supply. Average growth in direct sales to the transport sector is anticipated to be 2,5 percent a year until 2020. The growth trend of electricity sales to the transport industry follows the country's economic growth trend. Sales of electricity to the transport sector are influenced by maize and wheat exports and/or imports, raw material and finished goods. Factors impacting on the electricity consumption in the transport sector were increased road transportation; rationalisation of rail transport, tapering off of newly electrified rail transport and improved efficiencies. The growth of the mini-bus taxi industry also impacted on electricity sales to the transport sector. Electric vehicles are seen to represent a new source of electricity demand in the transport sector and this could account for some sectoral growth in the future.

1.4 Improved energy efficiency in energy supply

1.4.1 Demand-side Management in the industrial and commercial sectors

It is estimated that South Africa's electricity demand has increased by approximately 15 percent per year. If nothing is done, it could exceed the country's present surplus peak period capacity by 2007. This is the main reason for the country's energy efficient strategy, which envisages an overall energy saving of 12 percent (4 255 MW) by 2014.

Eskom has adopted a dual approach to reduce electricity demand at peak period (7-10 am and 6-8pm). The first is to encourage customers (domestic, commercial and industrial) to shift demand from expensive peak periods to off-peak periods. The second is to reduce off-peak period consumption by installing energy efficient equipment. Industries can manage their own load shifting activities without disrupting normal industrial process flow. Load management can be investigated or considered in many instances for example:

- Water pumps that feed into or from dams;
- Cooling equipment incorporated into cold storage facilities;
- Heating equipment that operates in collaboration with heat storage facilities;

- Material handling equipment that works in conjunction with silos;
- Stockpiles production equipment and plant utilities that can be scheduled to run off peak.

The industrial/mining and commercial sectors together account for about 77 percent of South Africa's total energy use (Eskom, 2005), thus providing a large potential for energy efficient interventions and energy savings.

The 2004 DSM programme focussed on industry and commerce with the following highlights:
- Savings in excess of 197 MW was recorded in the 2004 financial year;
- 197 MW and R1, 2 billion was saved during 2004.

DSM will remain focussed on commerce and industry with the key activities compromising the following:

Demand Market Penetration

On the Eskom Power Pool customers are treated as generators and through a tariff demand market participation (DMP) they are encourages to offer any flexible load onto the Eskom Power Pool. In reality, the customers tender their load reduction onto the pool, and not their generation capability. Customers may participate in the energy market, the reserve energy market or the instantaneous reserve market. When making load available in one or more of these markets, a compensation scheme based on schedules hours and MWh payments are applicable.

Co-generation

Co-generation programmes in industrial markets in particular through waste heat recovery or combined heat power are an efficient option and a cheaper alternative to supply side expansion. Co-generation technology provides greater conversion efficiencies than traditional generation methods as it harnesses heat that would otherwise be wasted. This can result in up to more than a doubling of thermal efficiency or higher heat values.

Residential CFL roll-out

DSM will provide 3 000 000 CFLS to communities in South Africa in order to reduce peak electricity demand. The Alexandra CFL roll-out project used at least 300 000 of the targeted lamps for replacement in the township. To encourage buy-in from the community and empowerment, project staff was drawn from the unemployed community members of Alexandra.

National roll-out of Residential Load Management

National roll-out of residential load management (RLM) is part of Eskom's overall DSM strategy and seeks to influence the way in which industrial, commercial and residential customers use electricity. The RLM project is specifically aimed at the residential sector and largely targets geyser usage patterns in households. One of the programmes launched to date involves the connection of ripple or radio-controlled units (relays) to geysers, allowing them to be switched off and on by remote control. Electricity consumption of better managed, especially during peak periods and load management is thus seen as an invention allowing the more efficient utilisation of available capacity, as it provides an alternative to new construction. 4. Improved efficiency in energy supply

1.4.2 Electricity generation

A tender for the new generation capacity was issued in December 2004 and responses, both internationally and locally, were received. In terms of long term planning, it has been established that there is a need for over 2500MW of new peaking capacity between 2006 and 2010. Eskom will be responsible for addressing the supply requirement up to the end of 2007, while the DME will ensure that an additional 1000MW of peaking power plant, in the form of Open Cycle Gas Turbines will be introduced by the end of 2008. DME is now engaged in various upfront activities that include site acquisition and where after an environmental impact analysis will be done (Mlambo-Ngcuka, 2005).

1.5 Reform or restructuring of the energy sector to improve the functioning of energy markets

Power sector reforms were planned to take place on two different levels - in the Electricity Distribution Industry, and in the Electricity Supply Industry. Power sector reforms in the EDI are now the only reforms envisaged.

To address concerns in the EDI, Government now plans to consolidate the EDI into a maximum number of financially viable independent regional electricity distributors (REDs). This process will amalgamate Eskom's distribution division with the local authority distributors into a number of regional electricity distribution companies or (REDs). As an interim step, Eskom Distribution will form part of a holding company, EDI Holdings Company, for the entire distribution industry, EDI Holdings. Eventually REDs will become independent of EDI Holdings.

Government's appointed technical advisors of this particular initiative, PriceWaterhouseCoopers, recently released working papers (PriceWaterhouseCoopers 2000) detailing views that have emerged following extensive (yet ongoing) analysis and various stakeholder meetings. Selections of these views are listed below:

- *On RED definition*, it is likely that six REDs should be established. Each RED will contain a major economic centre, and that RED boundaries are consistent with the new municipal boundaries and the electrical configuration of the network, as well as take cognisance of geographical constraints.
- *On ownership*, it has been suggested that shares should be used to compensate existing distribution undertakings for the value they contribute to the REDs, and that when Eskom has been restructured, shares in respect of Eskom distribution be held by national government.
- *On governance and legal status*, it is recommended that each RED be controlled by its own professional Board of Directors, elected by its shareholders. Furthermore, the REDs should be established as companies incorporated in terms of the Companies Act. National government (through the National Electricity Regulator, NER) will be responsible for setting and monitoring implementation of policy for the electricity sector as well as ensuring, through regulation, that municipalities perform their functions effectively.
- *On commercial arrangements*, REDs should purchase generation and transmission services by means of a regulated Wholesale Pricing System (WEPS). The WEPS would

contain separate generation and transmission components, both of which would be regulated. Once the wholesale energy market is established (see below), REDs would be allowed to purchase from this market. The regulatory regime would provide REDs with an incentive to minimise the cost of energy purchased on behalf of their customers, and would limit cross ownership between REDs and generation companies so as to encourage energy purchase to be made on a fully commercial basis. The NER would continue to regulate the price charged for access to the transmission network. Under this arrangement, some large industrial customers would be eligible to choose the company from which they purchase electricity.

- *On regulatory arrangements*, the new regulatory regime for the EDI should provide a role for local government (as envisaged in the Municipal Systems Bill) to complement the role of the NER. Local government would be involved in micro regulation of the RED in its area to meet its legal and constitutional obligations, and the NER would be concerned with macro regulation of the whole EDI with a view to meeting national objectives for the industry. The "end-state" regulatory regime for REDs would include (i) separate regulation of (and licences for) distribution activities, captive market retail activities and contestable market retail activities; (ii) efficiency incentives for the distribution business and the captive market retail business of REDs through regulation of the allowed revenue for each RED; (iii) tight monitoring and performance against quality of supply and quality of service standards.

Without substantial increases in tariffs, major reductions in distribution costs, or the curtailing of the electrification programme, it is furthermore recognised that this rationalisation and restructuring process alone will have limited impact on improving the overall financial health of the industry. It is for this reason that the White Paper on Energy Policy states "the entire industry (generation, transmission and distribution) must move to cost-reflective tariffs with separate, transparent funding for electrification and other municipal services."

The South African National Energy Regulator (NERSA) Act, which will replace the National Electricity Regulator (NER) in 2005 and also regulate gas and petroleum pipelines was finalised.

1.6 The use of economic instruments

In the electricity sector, a wholesale electricity pricing system is being developed and in the petroleum sector the spot pricing system has been implemented to assist the poor to make petroleum products more affordable. Illuminating paraffin (IP) has been zero rated for value added tax. A single national maximum paraffin price regulation has been introduced. An investigation is currently ongoing to make LPG cheaper by reducing the cost of the containers. Another into the regulation of LPG prices is also underway. A 30% reduction on the Fuel Levy for biofuels (for liquid fuels) is in place and the Designated National Authority office was established in the DME to ensure the implementation of the cleaner development mechanism and carbon trading

1.7 Participation of private companies in the electricity sector, impact on electricity services

Competition in the power generation sector was introduced in 2001 when the National Electricity Regulator (NER), licensed South Africa's first substantial independent power producer -

Gauteng's Kelvin Power Station. Kelvin is owned by the Greater Johannesburg Metropolitan Council, but a 50% stake is held by a consortium which includes foreign investors and a local empowerment partner, Global African Power.

The government has invited independent power producers to register expressions of interest in building, owning and running two new power stations to meet South Africa's growing energy demands. The new plants are expected to cost R6-billion to build and to be fully operational by the end of 2008. The power plant required would be oil-fired open cycle gas turbines operating as a peaking plant. The plants would ideally be situated along the country's coastline.

In the middle of 1997 a mini hydro project was identified in South Africa by a landowner and a civil engineering consulting firm. What makes this relatively unique is the fact that South Africa does not have many rivers with a constant yearly flow. Generally the rivers are dry in the winter period (May to October) and have a high flow during the summer months (November to April). The Axle River, where the project was identified, however has an average (guaranteed) flow, which is artificially regulated, from the Lesotho Highlands. This water flows via the Axle River over a distance of approximately 300 km to Johannesburg where it is used for drinking water purposes. The South African and Lesotho Governments have entered into an agreement guaranteeing the yearly flow in the river. Furthermore in the past, the generation of electricity was strictly regulated in South Africa and fell solely within the mandate of the national electricity utility Eskom. The new energy policy stance of the post-apartheid government allowing electricity generation by the private sector and the constant water flow in the selected rivers led to the project proposal being formulated. The project was subjected to a pre-feasibility study by the project initiators. This pre-feasibility study showed that the project was broadly feasible. In terms of size the project was relatively small (approx. US$ 4,5 million). However the sunken costs for a project (detailed feasibility and development costs) are typically independent of its size. Small projects therefore have a relatively high sunken cost percentage in relation to the total investment. This problem, which is universally encountered, prevented the project from going forward. The project initiators therefore approached a Dutch consultant with the request to investigate the possibility of some form of concessionary finance to cover the sunken costs. The project parameters made the project an ideal candidate for the AIJ-programme of the Netherlands Government. The project is in the renewable energy sector, mitigates large amounts of CO2, has a developmental function and is commercially sustainable. South Africa is also a signatory of the Kyoto Protocol.

1.8 Major groups participation in energy decision-making

The minister has established different groups of women who assist in decision-making. These are: Women in Oil and Energy (WOESA); Women in Nuclear (WINSA) as well as Technology for Women in Business (TWIB).

1.9 Women's participation in needs assessment or planning and policy formulation

While policy is developed NGO's and CBO's are invited to attend workshops and to comment on the draft documents but there are no specific avenues to include or ensure women's participation in the policy process. However the DME has initiated and subsidised the development of

Women in Oil and Energy South Africa, (WOESA) an association of female entrepreneurs and WOESA does participate in consultative forums.

1.10 Programmes designed to increase the share of renewable energy in the national energy mix

The White Paper on Renewable Energy, approved by Cabinet in November 2003 set a specific target for the contribution of renewable energy to final energy consumption by 2013 in South Africa. The set target of 10 000 GWh (0.8 Mtoe) translates to approximately 5% of present total annual electricity generation. The target is envisaged to be achieved by utilising a mix of different renewable energy resources and technologies, but renewable energy utilised for power generation and non-electric technologies such as solar water heating and biofuels are specifically mentioned in the White Paper. Furthermore, the assumption is (based on the draft strategy for renewable energy) that the selection of renewable applications will be based on the least-cost principle. It is envisaged that the 10 000 GWh target will be implemented in three phases during the 2004 - 2013 period.

Parastatal electricity utility Eskom and the State-owned Central Energy Fund (CEF) are to play a large part in the development and financing of these projects. CEF has established the Energy Development Corporation, which is to investigate opportunities and invest in the field of renewable energy as well as prepare business cases for viable initiatives.

Government is looking into creating an incentive scheme for project developers active in the different fields of sustainable energy to encourage wider participation. This will initially take the form of once-off capital subsidies, to be replaced in the long term with other possible instruments, such as renewable energy certificates.

A large number of projects are currently being proposed for South Africa. These include biogas projects at several landfill sites countrywide; a commercial wind farm near the Western Cape town of Darling; a 50 MW wind farm to be built by Spanish utility EHN elsewhere in the Western Cape; a 100 MW concentrated solar power plant using receiver technology earmarked for construction in Upington, in the Northern Cape, by 2007; a wind-assisted pumped-storage scheme in the Eastern Cape; and a mini-hydro plant in Bethlehem, in the Free State. Government's nongrid electrification programme, has been implemented since 2001 and focused on using renewable energy as a cost-effective solution to provide electricity to remote areas, is currently under review.

The DME with the assistance of the Capacity Building in Energy Efficiency and Renewable Energy (CaBEERE) project, funded by Danida, has launched an initiative to establish the national office for management of financial subsidies for Renewable Energy in South Africa. It is envisaged that the Office will initially focus on subsidies and finance for grid-connected renewable energy, but that financial instruments for non-grid and bio-fuels if relevant will fall under the auspices of this Renewable Energy Subsidy Office at a later stage. The ultimate aim of the Office is to facilitate the approved 10,000 GWh target for the uptake of renewable energy in South Africa. A second initiative was launched to monitor how the RE target is achieved.

1.11 Transport efficiency

Standards for cleaner fuels have been developed and are in the process of being implemented. The taxi recapitalisation project will focus on the safety of taxi's, which will also address energy efficiency in that subsidies will be given for the scrapping of old petrol powered taxis and their replacement by new , safer, diesel powered taxis which will be more energy efficient.. The DME has been running a public education programme aimed at motorists driving habits with a view to more fuel saving efficiencies. The energy efficiency strategy has a target of an improvement in transport efficiency of 9% by 2015. A number of activities are listed here including a move from road to rail for bulk transport of goods.

1.12 Nuclear energy programme

During 2004 the South African Cabinet has approved a programme to develop human capital and improve research and innovation in relation to the pebble-bed modular reactor (PBMR) project. PBMR technology in South Africa has been under development for the past 10 years, while it has worked for more than 20 years in Germany. The aim of the South African PBMR is to provide a cheaper form of electricity for those who have no or limited access to electricity.

The development of the PBMR is strongly opposed by various environmental groups.

B.2 Capacity building, information and research technologies

2.1 Efforts to establish new, strengthen or reform existing national and local institutions responsible for national programmes on energy for sustainable development

Local authorities are not only great consumers of energy but have the power and responsibility to initiate and manage a more sustainable energy path. The development of an Energy & Climate Change Strategy for EMM is a key step towards institutionalising sustainable energy approaches and practices within the municipality.

Energy plays central role in the functioning of cities and yet South African cities are very new to current global energy debates. South Africa has ratified the Kyoto Protocol and is one of the developing world's heaviest carbon emitters: this means that, while we are not yet obligated, South African cities should become part of leading the way in reducing carbon emissions. Driven by issues of climate change & inspired by cost savings & better service delivery, other cities around the world are making pioneering & cutting edge interventions to address their energy issues in an integrated way. This is having far reaching implications for these cities in terms of social development, environmental sustainability, service delivery, citizen involvement and resource efficiency.

For local governments, sustainability means thinking, planning and acting in the long-term, examining all the impacts of decisions made today with tomorrow in mind. Local governments make decisions affecting land use, building codes, transportation systems and waste disposal, and each of these decisions impacts energy use.

A City Energy Strategy is a plan that aims to integrate and entrench sustainable energy approaches and practices at the local level, within a framework that has a clear vision and direction. It will prioritise and co-ordinate ad hoc energy projects and activities, and will help to integrate energy objectives into relevant functions and programs. It can improve service delivery and quality of life, save money & reduce greenhouse gas emissions. It will assist the city in building its overall city development strategy. Energy is the backbone of the city, and, while being very specific, it is also an entirely cross-cutting sector which has serious social, economic and environmental impacts. As such, an energy strategy provides a means for cities to work with and implement integrated development planning and so build their ability to apply this throughout the city. The detrimental impacts of modern energy consumption practices cannot be reversed overnight, so sustainable energy planning must be an ongoing, dynamic activity.

In November 2003 Sustainable Energy Africa (SEA), the South African Cities Network (SACN) and the City of Cape Town successfully hosted the "City Energy Strategies Conference". This was done in association with the International Council for Local Environmental Initiatives (ICLEI), the South African Local Government Association (SALGA) and endorsed by UNEP. The conference was well attended by high-level decision makers nationally and locally. An outcome of the conference was the Cities Energy Declaration challenging cities to set a more sustainable energy path for them.

The Development of Ekurhuleni Metropolitan Municipality (EMM)'s Energy & Climate Change Strategy Ekurhuleni is one of the largest and most energy intensive cities in South Africa with a diverse industrial, manufacturing and commercial sector so industrial and commercial consumption currently accounts for a massive portion of total energy used in Ekurhuleni.
The Ekurhuleni Metropolitan Municipality is committed to a more sustainable energy path, particularly in its own operations. It has recently completed a State of Energy Report for the Ekurhuleni area. They also have a champion at the highest level with the support of the Executive Mayor, Duma Nkosi as well as a lead office in the form of the Environmental Management Department. EMM has also recently become a participant in the Cities for Climate Protection (CCP) Campaign coordinated by the International Council for Local Environmental Initiative (ICLEI). This campaign is a global initiative of local municipalities to take action to mitigate against the impact of human-induced climate change.

Within an area of 190 147 ha and a population approaching 2,5 million with increasing urbanisation, it is imperative that planning within EMM takes cognisance of the energy use, energy cost and impact of the energy use on the local and global environment. EMM is not only a big user of energy but also ideally placed to influence the energy use of the 8000 industries within EMM and the 17 000 employees including the planners and service providers in the municipality. EMM is a member of the South African Cities Network and contributes 23% to the gross geographical product of the Gauteng province. EMM can lead the way for sustainable energy use and production for other municipalities in this province.

One of the key performance areas identified for the EMM's Environment and Tourism department is the development of a strategy to institutionalise sustainable energy approaches and practices in the Municipality. One of the steps to move EMM towards the goals of sustainable development is the drafting of EMM's Energy and Climate Change Strategy. This process will

begin in March 2005 and a final draft is expected at the end of May 2005. This Energy & Climate Change Strategy for EMM will not only have impacts of energy use on the local environment but also the contribution of the energy use to the increasing greenhouse gas emissions, which will assist EMM is achieving its milestones under the CCP campaign

The extension of the City of Cape Town's Energy Strategy to an "Energy & Climate Change Strategy" Sustainable Energy Africa (SEA) completed State of Energy Report for the City of Cape Town and coordinated the draft City of Cape Town Energy Strategy in 2003. SEA has also completed a greenhouse gas inventory for the City of Cape Town and assisted with the identification and development of emission-reduction projects. The City of Cape Town Energy Strategy has now been extended to being the Energy and Climate Change Strategy and is planned to be adopted this by end of March 2005.

City of Tshwane

SEA is also currently supporting Tshwane Metropolitan Municipality (TMM) to develop a sustainable energy strategy for their city, through DANIDA and TMM funds.

2.2 Training or other capacity-building activities undertaken to strengthen energy planning, management of energy efficiency or development of new and renewable sources of energy

A number of workshops have been arranged for persons interested in energy management and renewable energy to ensure capacity building. These are taking place to ensure the proper implementation of the energy efficiency strategy for the different sectors. The industrial sector does not require that much training, the public buildings sector requires a lot of training and workshops have been held with the line departments.

2.3 Launching of public information campaigns and educational programmes to raise awareness of energy efficiency and environmentally sound energy systems

May has been declared energy efficiency month and during the month 75% of the population were reached with radio messages, taxi rank promotions and street theatre. This included also the safe and efficiency use of paraffin, coal, liquid fuels and electricity. This year the campaign lasts from may to August and next year it will be even longer.

2.4 Efforts to promote increased research and development of various energy technologies

The department of science and technology is working in close cooperation with the DME and are investigating new technologies e.g. fuel cells. Eskom has also been encouraged to investigate new technologies e.g. wind farms etc.

Government has approved plans to set up the National Energy Research Institute (NERI), which will, among other things, support studies into the commercialisation of renewable energy, new

sustainable energy technologies and energy efficiencies. NERI will be housed within the Central Energy Fund (CEF).

B.3 Financing

3.1 Measures to establish an appropriate enabling environment conducive to attracting investments in the energy sector

The current price structure for energy derived from coal, crude oil and nuclear does not include environmental externalities and does not reflect the costs that production has on society at large. Liquid fuel prices are presently composed of a cost-related component and a variety of duties, levies and taxes emanating from different government departments. These taxes are utilised to raise revenue for the general fiscus and for specific policy purposes:

The various energy sub-sectors are subject to different fiscal policies:

Productive activities in all sub-sectors are subject to value added tax (VAT) with the exception of certain petroleum products. Paraffin was zero-rated in April 2001, as part of the Free Basic Services policy.

Income tax is currently payable by private sector corporations in the coal, liquid fuels, gas and renewable sectors, and only recently by Eskom.

Special taxes and levies: Special taxes and levies apply to some sectors, notably the petroleum sector, where the fuel levy constitutes about one-third of the pump price of petrol and diesel, contributing almost ten per cent of central government's revenues. A levy (set at a fraction of a cent per kWh) is also applied to electricity sales by generators over a certain size to raise funds for the operation of the NER tariffs. Historically, substantial tariff protection has been provided to the synthetic fuels industry, with a direct effect on the price of fuel to consumers.

Public sector electricity suppliers (both Eskom and local authorities) extract sizeable surpluses from some of their electricity customers for purposes of cross-subsidising other customer classes and, in the case of local authorities, other municipal services. The net effect of these practices is that levies and taxes make up a high proportion of the retail price of some fuels and a low proportion in other cases. Eskom has, in the past, enjoyed exemption from taxes (except VAT), while distribution has been subject to implicit local government taxation. Petroleum products are, for the most part, relatively heavily taxed, with close to half the pump price of petrol comprising government taxes and levies, but excluded from VAT, whereas coal is subject only to company taxes and VAT. In the case of the informal domestic coal market, not even VAT is collected. In terms of electricity, the future trend in prices to end-users will be dominated by two factors: trends in costs of electricity generation, and rationalisation of the distribution industry. Price levels vary significantly across the country, with smaller distributors tending to offer higher prices. The proposed rationalisation of electricity distribution into 6 REDs is expected to result in a small average reduction of costs.

Eskom has significantly reduced the real price of electricity over the past decade. As excess capacity is used up (as is expected within the next five years), price reductions will come to an end. New capacity will be more expensive than Eskom's current average costs of supply, and will tend to increase overall costs of bulk supply. However, in the medium term it is anticipated that this effect will be relatively small, and so will have only a minor impact on prices. An article in the Business Day (April 1 2003) estimated that SA would run out of peaking capacity by 2007, and base-load capacity by 2010. While this does mean that new power stations are to be built, the NER stressed that they would strive to maintain the position of SA as having among the lowest electricity prices in the world.

In terms of liquid fuels, the price at which refineries sell their products is controlled by the State. This price is determined by a so-called "Basic Fuels Price" (BFP) which is the cost at which products could be landed in South Africa if they had been sourced from a basket of refineries mainly in the Far East. The mark-ups or 'margins' of the South African refineries are therefore very similar to those in the Far East. When the Far East market changes its nature, it has a direct and immediate effect on the economics of the South African refineries.

B.4 Cooperation

4.1 Cooperation with neighbouring countries in energy trade and interconnection of electricity and gas networks

4.1.1 SAPP

The August 1995 Inter-Governmental Agreement creating the Southern African Power Pool (SAPP) confirmed the region's commitment to expanding electricity trade, reducing energy costs and providing greater supply stability for the region's 12 national utilities: Botswana Power Corporation (BPC); Electricidade de Mocambique(EDM); Angola's Empresa Nacional de Electricidade (ENE); Electricity Supply Commission of Malawi (Escom); South Africa's Eskom; Lesotho Electricity Corporation (LEC); Namibia's NamPower; Swaziland Electricity Board (SEB); the Democratic Republic of Congo's (DRC) Societe Nationale d'Electricite (SNEL); Tanzania Electric Supply Company (Tanesco); Zimbabwe Electricity Supply Authority (ZESA) and Zambia Electricity Supply Corporation (ZESCO).

The SAPP's original primary objective was to provide reliable and economic electricity supply to the consumers of each member. The SAPP is now evolving from a cooperative to a competitive pool. Power trade continues to increase steadily annually at an average of 20%. The value of the electricity traded in 1999 was over $150 million. A short-term energy market (STEM), which started live trading in April 2001, utilizes the Internet to conduct trades. The STEM is a spot market of non-firm electricity contracts. IPPs (HCB, Kariba North Bank Company, and Zimbabwe Power Company) will participate in the STEM, subject to clarification of their status.

A significant SAPP accomplishment was the completion of the Matimba-Insukamini interconnector linking Eskom and ZESA in October 1995. This interconnection initiated the first linkage of system operations between the northern and southern electrical systems in the Southern African region. The northern system is primarily composed of ZESA (Zimbabwe),

ZESCO (Zambia) and SNEL (DRC), while the southern system is primarily Eskom (South Africa), BPC (Botswana) and Nampower (Namibia). The effect of the interconnections is that countries are able to source electricity in bulk and then redistribute it nationally at cheaper prices. Plans to connect the power grids of Angola, Malawi, and Tanzania with other SAPP member grids are in varying stages of development.

4.1.2 Natural Gas

Several initiatives are ongoing to introduce natural gas into South Africa. Studies are in progress to research the possibility of using gas from the Kudu gas field off the coast of Namibia to power a combined cycle gas turbine power station which would be located in the Western Cape, as well as to investigate the possibility of establishing industries along the pipeline. Agreements have been signed between the South African Government (and incorporated into the Gas Act of 2003), the Mozambican government and the petrochemicals group, Sasol, to pipe gas from the Pande and Temane gasfields in Mozambique to the Sasol Secunda plant from the year 2004. The national gas companies of South Africa (iGas) and of Mozambique own 50% of the gas pipeline and SASOL the other 50%. Sasol is likely to use the gas in three ways: as a supplementary feedstock to coal at an expanded Sasol Synthetic Fuels plant in Secunda; to replace coal as a feedstock at the Sasol Chemical Industries plant in Sasolburg, if a feasibility study proves positive; and to expand its existing pipeline gas market. The Central Energy Fund has begun to explore the possibilities for CDM project development flowing from the Mocambique gas import.

4.1.3 NEPAD

In its resolution 57/7 of 4 November 2002, the General Assembly of the United Nations urged the international community and the UN system to organize support for African countries in accordance with the principles, objectives and priorities of the NEPAD. In this regard, the annual regional consultations of the UN Agencies working in Africa, convened by the Economic Commission for Africa (ECA), provide the framework for coordination and collaboration among the entities of the UN system in their response in support of the NEPAD Initiative.

In these consultations, it was decided to establish five clusters with a view to enabling agencies and organizations of the UN system to pool their efforts and build synergies in support of NEPAD in a cost-effective and coordinated manner. Within the framework of this cluster approach, ECA is the convenor of the Cluster on NEPAD infrastructure development, which includes sub-clusters on energy, water and sanitation, transport, and information and communications technologies (ICT). Five sessions of the annual regional consultations have been organized so far and three out of the four infrastructure sub-clusters, except the energy sub-sector, are already well organized and operational.

4.1.4 SADC

The SADC Energy Ministers Meeting in June 1996 in Swaziland accepted the proposals of consultants that an Energy Commission replace SADC's existing Technical and Administrative Unit (TAU). The Energy Commission is smaller: 9 members instead of the current 50 members

of TAU. The EC will also be a facilitating administrative unit, not an executive unit. The SADC Energy Policy and Strategy Document (a working document applying the SADC Energy Protocol) was approved by the SADC Heads of Government Summit in Maseru on 24 August 1996.

Platforms for SADC cooperation in energy have been set through the 1982 and 1992 policy documents entitled "Towards an Energy Policy for Southern Africa" which was translated into the SADC Protocol on Energy signed by all member states in 1996.

Electricity has been shared between the DRC and Zambia as early as the mid-1950s. Today, the Kariba power plant is jointly operated by Zambia and Zimbabwe through the Zambezi River Authority (ZRA) established in 1987, succeeding the Central Africa Power Corporation. The erection of a 340-km long, 220 kilovolts (kV) transmission line between Bulawayo (Zimbabwe) and Francistown (Botswana) is facilitating the export of electricity, mainly hydropower from Zambia to Botswana. Recently, the ZRA signed a contract with ESKOM (South African electricity utility) for the production and sale of hydropower energy. A similar deal has been concluded with Mozambique, including a tripartite agreement between Mozambique, Portugal and South Africa for the rehabilitation of Cahora Bassa infrastructure. Zimbabwe has just begun importing about 400MW of power monthly from Cahora Bassa through the Songo-Bindura-Dema 420kV interconnector while negotiations for 30 percent stake in the Cahora Bassa Hydropower station were ongoing in May 1998.

Probably, the most notable achievement is the establishment of the Southern African Power Pool (SAPP) in 1993, which was signed by all SADC countries in 1995. The SAPP aims at providing electricity to all SADC countries in an environmentally sound manner and also focuses at drawing hydropower from the Inga Hydropower plant which has a potential of generating up to 100,000MW using the natural flow of the Congo River to turn turbines. www.sardc.net/imercsa/zambezi/zfsheet/zfsheet02.html - 20k

B.5 Case Study of a Successful national energy programme/strategy

5.1 The problem or issue addressed

In South Africa, an estimated 18 million people live in approximately 3 million dwellings of an informal nature, relying on polluting fuels to fulfil their daily energy needs. However, it is not only households in informal settlements that are affected by air pollution form dirty fuels. Low to medium income households in formal areas, despite having access to electricity, are still using cheaper fuels such as coal and paraffin to provide cooking and space heating energy – electricity is largely being used for lighting and entertainment purposes and occasional cooking. Especially in cold winter climates such as the Gauteng Highveld area, areas of Mpumalanga and the Orange Free State, households use coal as an energy source because of its dual and even triple functionality – it provides energy for cooking, water heating and space heating in one, using only one appliance, the family coal stove. Lastly, all households in areas adjacent or close to coal burning areas suffer from the effects or air pollution since everybody has to breath the air out there, even if you live in an affluent suburb.

South Africa's industrial and power generation sectors are responsible for some air pollution, but studies conducted in Gauteng (Scorgie *et.al, 2003*) found that household coal burning was the largest contributor to air pollution in the area – electricity generation contributed 5%, industries and commercial organisations contributed 30% and domestic coal burning contributed 65%. A similar study (Matthee, 2004) found source contributions to quantifiable particulate emissions in the city of Johannesburg to be 48% attributable to domestic coal burning, 22% to scheduled processes, 20% vehicle-tailpipe emissions and 10% to tailings impoundments. Communities are aware of the effects of coal use and the Orange Farm respondents indicated that they experience smoke as a problem in the area, as illustrated in Figure 1, below:

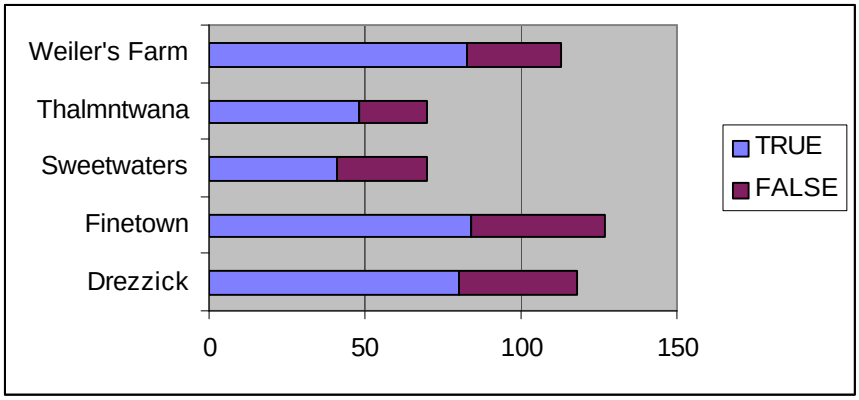

Figure 1: Respondents experiencing smoke as a problem per area. Source PDC, 2005. BNM Final Report.

The worst incidents of poor air quality in South Africa occur with the burning of wood, dung or coal (Terblanche, *et al*., 1992). This situation proves to become particularly problematic when these fuels are used within poorly ventilated households, especially in informal settlements and rural villages. According to Scorgie et al (2003), approximately 2000 children die annually as a result of respiratory infections caused by air pollution. It is considered the sixth largest killer of children under four in South Africa, and it is estimated that illnesses related to air pollution cost Government in the order of R1, 2 billion per annum (Trade and Industry Chamber, 2004).

5.2 Name of the Programme

This Basa Njengo Magogo[1] (BNM) method was first introduced by the Nova Institute, to the eMhalenhle community near Secunda (van Niekerk and Swanepoel, 1999). The BNM method was named after an elderly lady, Granny Mashinini. She represented one of ten households that Nova demonstrated the old "Scotch-fire" lighting method to. Nine of the households reported that the method did not work, but Granny Mashinini reported that she got the fire to burn after adding a handful of coal on top of the burning wood in the brazier. The addition of the coals added on top provided enough energy to ignite the coal at the bottom.

[1] Translated, Basa Njengo Magogo means, "to make fire like Granny" in reference to Granny Mashinini in eMhalenhle who perfected the top-down fire lighting method.

5.3 Timeframe

Initial research started in 1996 but the actual implementation phase commenced in 2003.

5.4 Status

Ongoing

5.5 Main Objectives

The BNM method is an attractive intervention to address air pollution caused by domestic coal burning because of the relative low cost associated with its implementation. The Trade and Industry Chamber (2004) concluded that BNM represented the highest impact on health from a benefit-cost and employment point of view. Furthermore, households do not incur any expenses when they switch to the fire lighting method – they don't have to buy special fuel or equipment to be able to use the method – which makes it easy and attractive for household to implement the fire lighting method. The benefits associated with the method were summarised by van Niekerk and Swanepoel (1999):

- Environmental – this method can potentially reduce ambient particulate air pollution caused by the use of household coal in a relatively short period, by approximately 40-50%. However, using the BNM method does not reduce invisible gaseous air pollutant concentrations, such as sulphur dioxide (SO_2), volatile organic compounds (VOCs) and carbon monoxide (CO). The particulate emissions were between 8% and 28% lower from the Basa njengo Magogo fires than with the conventional method of lighting the fire (while using the same coal) (Le Roux et al., 2005). SO_2 emissions from the two methods (using low-grade coal) were identical. It is not possible to compare the particulate and SO_2 emissions to health guideline values due to the method of determining the emission rates. However, health effects are anticipated to be less since particulate exposure is less and risk is a function of exposure. The conventional bottom-up ignited fires had a longer period (about 10 minutes) before peak CO concentration was reached (about 650 ppm). The concentration then remained between 300-450 ppm for about 30 minutes before decreasing to about 150 ppm. With the Basa njengo Magogo method the CO concentration peaked within about 3 minutes at about 500 ppm, remained at this concentration for another 2 to 3 minutes when it decreased rapidly to about 150 ppm (Le Roux et al., 2005). The latter procedure thus lowers the exposure time considerably and can therefore be considered as having lower risk to human health. However, in both methods the hourly WHO standard of 35 ppm was still exceeded for CO (WHO, 2004). Thus it is imperative that other interventions, such as building homes with chimneys or socio-behaviour changes, must be implemented with the Baso njengo Magogo in order to reduce exposure to gaseous pollutants (such as CO, SO_2, VOCs).
- Cost element – with conservative estimates indicating that it would cost between R25 million and R50 million to implement this method in one million households;
- Financial benefits – savings in the health costs carried by Government, associated with air pollution. The potential savings to households were calculated at approximately R150 million as a result of the decrease in the amount of coal used due to this method.

The BNM method has a direct impact on the way in which coal combusts in the lightning process, resulting in a significant reduction in visible smoke and particulate matter. The method is based on the principle of putting the coal first in the brazier, followed by newspaper, and then wood on top. The paper and wood is lighted, and when it is burning well, two handfuls of coal are added on top. The main idea is that the fire burns from the top-down; affecting the combustion process in such a way that the smoke (but not invisible gaseous air pollutant concentrations, such as sulphur dioxide (SO_2), volatile organic compounds (VOCs) and carbon monoxide (CO)) emitted from the burning process is reduced by up to 50%, whilst increasing the efficiency while the coal is burning. The advantage of the introduction of the new method is that it can be used in either braziers or coal stoves[2], or even in open fires and does not threaten the position of the coal merchants, as it does not attempt to substitute coal with another energy source.

5.6 Lead institution

Department of Minerals and Energy (DME)

5.7 Other implementation arrangements and stakeholders involved

- Local Authorities (Johannesburg Metro, Ekurhuleni Metro)
- Council for Scientific and Industrial Research
- Private implementation companies (NOVA Institute, Palmer Development Consulting, Menyetla Projects, Akanani Mitiya)

5.8 Project results

5.8.1 Take-up rates

In the first follow up session one or two days after the demonstration, already 84% of households started using the method, and most of them reported that they would continue to use the method in future. The 16% of households indicating that they would not use it in future actually don't use coal or did not have coal in the house to try the method. A week after the demonstration, 96% of the households were using the method every day, thus there was an increase from 84% to 95%. The percentage of households reporting that they are still using the method after a month, increased to 99%, of which 1.7% of those households using the method did not use coal before. The suggestion here is that coal use actually increased overall due to the fact that a new, cleaner alternative lightning method became available and people felt safer to use the method.

5.8.2 Coal and monetary savings

Coal savings and associated monetary savings arise from the fact that with the BNM method, coal is burned more efficiently. Smoke is unburned carbon or unburned energy and with the conventional method, the energy in the smoke is lost, while with the BNM method the smoke is burned and available as useful energy. Secondly, when the method is used in a coal stove, the fire is made at the top of the stove, providing instant heat for cooking on the stovetop.

[2] The BNM method can be used for lighting any coal fire and works in braziers (mbawualas), coal stoves and open coal fires as used for funerals, weddings or community feasts. During the demonstration programme braziers were used in street demonstrations because they are easier to carry around.

Households therefore, do not have to wait 20 minutes for the stove to warm up before cooking can start. Respondents reported saving coal and that their fire last longer: During the daily follow-up 14% of respondents reported that they liked the method as it saves coal, and 31.6% reported that the fire lasts longer. The weekly follow-up reported 11.4% of respondents liking the method because it saves coal (meaning a 2.6% decrease), and 40.5% of respondents felt that the fire lasts longer.

The actual amount of coal saved varied from household to household but the majority of households indicated coal savings of half a bag per week (25 kilograms). The various levels of coal savings reported is illustrated in Figure 2, below:

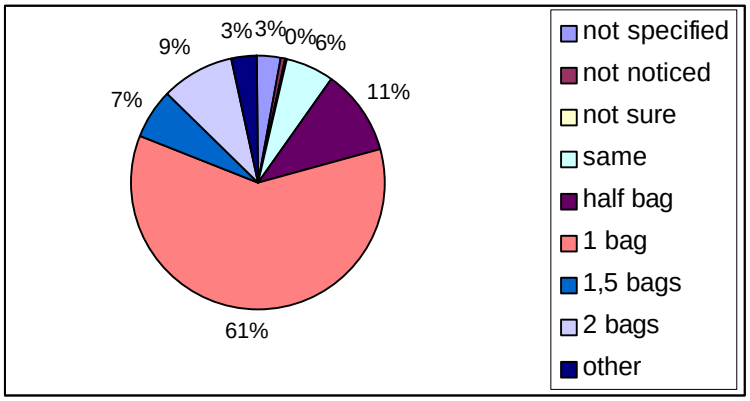

Figure 2: Reported coal savings after a month of using BNM. Source BNM Final Report, 2003.

Most of the households (73%) used to make a fire twice a day with the conventional fire lighting method, but 92% of those households only needed to make fire once per day with the BNM method. Coal savings has a direct impact on the household budget, and on average, households reported spending R104 per month on coal for 4 bags of coal in the 5 study areas. Should the households save one bag per month by using the BNM method, they would at least save R26 per month.

There are also other indirect monetary savings such as expenses associated with health and education, which could not be quantified through the study quantified.

5.8.3 Reduction in air-pollution

Households, scholars and schools were interviewed to obtain their perception on air pollution, and all 12 schools interviewed reported air pollution as a problem in their area. Of the scholars interviewed, 59% reported smoke being a problem in their households. These scholars might be so accustomed to smoke in their households that it does not bother them that much, but 84% of them definitely perceived it as a problem in their community. After the households had time to try and test the method, they were asked in both the weekly and monthly follow up whether they noticed less smoke when lightning a fire and if they noticed less smoke in their community. The weekly follow up indicated a 76% positive feeling towards less smoke when lighting the fire, and the same figures apply to the monthly follow-up. In the weekly follow-up, 55% of households

noticed less smoke in the streets, and during the monthly follow-up, 67% of them noticed less smoke in the streets.

5.9 Relationship of the programme to internationally agreed goals and targets

Reduction of severe air pollution, improvement of quality of life.

5.10 Conclusions and recommendations

The potential impacts of coal and monetary savings were verified in the project area and reported improvements to smoke reduction and health documented. The project demonstrated the implementation of a demonstration and awareness programme and reached the required number of households. The conclusions drawn were:

The implementation of the BNM method can reduce particulate air pollution (but not invisible gaseous air pollutant concentrations, such as sulphur dioxide (SO_2), volatile organic compounds (VOCs) and carbon monoxide (CO)), effect coal and monetary savings and improve the health of communities dependent on coal as an energy source for space heating and cooking. Thus it is imperative that other interventions, such as building homes with chimneys or socio-behaviour changes, must be implemented with the Baso Njengo Magogo in order to reduce exposure to invisible gaseous pollutants;

An awareness raising and information dissemination campaign would be strongly dependent on demonstrations. Demonstrations have a double impact – it teaches people how to make a BNM fire and it shows the difference between a conventional and a BNM fire. As the difference in smoke release is quite dramatic, it is a very effective way to convince people of the benefits of the method;

Although implementing a demonstration and awareness raising programme is logistically challenging and resource intensive, the project demonstrated that it is achievable. Furthermore, the cost of R38 to reach a household as demonstrated in the project may be lowered to as much as R17 per household with greater efficiencies and a smaller research component per project.