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Technical Report:

**National Energy Policy For Botswana –
Final Draft**

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REPUBLIC OF BOTSWANA

GOVERNMENT OF THE REPUBLIC OF BOTSWANA

Ministry of Minerals, Energy and Water Resources

Energy Affairs Division

NATIONAL ENERGY POLICY

Final Draft

March 2009

TABLE OF CONTENTS

ABBREVIATIONS and ACRONYMS.....	4
EXECUTIVE SUMMARY.....	5
1.0 INTRODUCTION.....	8
2.0 BACKGROUND AND CONTEXT OF THE NATIONAL ENERGY POLICY	10
3.0 GOAL AND OBJECTIVES OF THE NATIONAL ENERGY POLICY	12
4.0 SITUATIONAL ANALYSIS.....	14
5.0 CONSOLIDATED ISSUES	24
6.0 THE GOALS OF THE NATIONAL ENERGY POLICY	29
7.0 WAY FORWARD	35
8.0 REFERENCES.....	37
9.0 ANNEX 1 – LISTS OF CONTACTS.....	38

ABBREVIATIONS and ACRONYMS

BEMP	Botswana Energy Master Plan
BEST	Biomass Energy Strategy
BOCONGO	Botswana Council for Non Governmental Organizations
BOTEC	Botswana technology Centre
BPC	Botswana Power Corporation
CBM	Coal Bed Methane
CDM	Clean Development Mechanism
DSM	Demand Side Management
EAD/DEA	Energy Affairs Division/Division of Energy Affairs
ESI	Electricity Supply Industry
FAB	Forestry Association of Botswana
GDP	Gross Domestic Product
GHG	Greenhouse Gas
IAEA	International Atomic Energy Agency
ICT	Information Communication Technology
IEP	Integrated Energy Planning
LPG	Liquefied Petroleum Gas
MDG	Millennium Development Goal
MJ	mega joule
MMEWA	Ministry of Minerals, Energy and Water Affairs
MMEWR	Ministry of Minerals, Energy and Water Resources
MW	Megawatt
NDP	National Development Plan
NEP	National Energy Policy
NGO	Non Governmental Organization
NPVREP	National Photovoltaic Rural Electrification Programme
NRSE	New and Renewable Energy Source
R&D	Research and Development
REPGA	Regional Petroleum and Gas Association
RERA	Regional Electricity Regulatory Association
RIIC	Rural Industries Innovation Centre
RRA	Regional research Alliance
SACU	Southern African Customs Union
SADC	Southern African Development Community
SAPP	Southern African Power Pool
SIRDC	Scientific and Industrial Research and Development Centre
SMME	Small, Medium Scale Enterprises
SWH	Solar Water Heaters
TCF	Terra Cubic Feet
WESTCOR	Western Corridor

EXECUTIVE SUMMARY

The Ministry of Minerals Energy and Water Resources through the Energy Affairs Division is responsible for the formulation, direction and coordination of the national energy policy. The overall policy goal for the energy sector is to provide affordable, environmentally friendly and sustainable energy services in order to promote social and economic development.

The Draft Energy Policy for Botswana has been developed through a process that involved literature review, consultations of key stakeholders along sub-sectoral and thematic lines. The key stakeholders consulted included government of Botswana, as well as consumers and energy producers from the following sub-sectors: electricity, coal, oil and gas, energy efficiency and biomass. Consultations were also done along the themes: Access to Energy Services; Market Mechanisms and Resources and Supply. The literature reviewed includes Botswana's Vision 2016, the National Development Plan (NDP 10), Botswana Energy Master Plan (BEMP), Biomass Energy Strategy among others. The views and contributions from the various consultations were consolidated at a national (Consolidation) workshop held on December 4, 2008.

Energy Resources

Botswana's energy resource base is dominated by huge coal reserves estimated at 212 billion tons. Only the Morupule Colliery is currently operational most of the coal is used for electricity production. The resource and economic potential for coal bed methane (CBM) is still to be established, although estimates put the CBM resource potential at approximately 35 terra cubic feet (TCF). Botswana has no known petroleum reserves and the country has to import all its petroleum requirements in refined form, mainly from South Africa. The woody biomass loading ranges from 3.6 to 4.3 tons per ha per annum for shrub savannah to 4.8 to 10.6 tons per ha per annum for dense forest. The mean annual solar insolation is 21 MJ per m² per day, one of the highest radiation levels in the world. Average wind speeds range from 2.0 to 3.5 m/s, considered too low for viable wind based power generation.

Key Policy issues

The key policy issues identified by stakeholders were:

1. Inadequate security and reliability of energy supply to all sectors of the economy

Botswana has to import all of her petroleum fuels in a refined form from or through South Africa. Limited supply routes have led to periodic bottlenecks in fuel supply. This is exacerbated by inadequate internal strategic storage capacity and the long distances to supply all parts of the country. Internal electricity generation capacity can supply only about 80% of the country's requirements, the balance having to be imported from the Southern African Power Pool (SAPP), which is also experiencing a capacity shortfall.

2. Poor access to affordable energy services for all sectors of the economy, particularly the low income and marginalized

Access to commercial energy is low with the majority of the population depending on noncommercial energy, mostly biomass. Access to electricity stands at 49% (2008), with the figure for the rural areas being 43%.

3. Lack of energy hampering socio-economic development and causing social hardships to the people of Botswana

The time taken and the distances walked to collect firewood in wood deficit areas leave the affected communities leading a life of drudgery with less time to concentrate on economic activities.

Areas without access to electricity cannot enjoy such essential services as medical refrigeration, street lighting and use of modern information communication technology (ICT).

4. Ineffective institutional arrangement and governance for the energy sector

Lack of clarity of roles for the various players in energy delivery has affected the implementation of programs. This is especially so for biomass programs in rural areas where coordination of the many players has not been very effective.

5. Inadequate capacity for service delivery for key stakeholders in the energy delivery chain

Government lacks adequate capacity for planning (Integrated Energy Planning) and program implementation due to high staff turn over and limited skills.

6. Lack of energy information for policy, planning and decision-making.

Data and information on energy resources and issues, especially on non-commercial energies like biomass are lacking, which makes planning and policy formulation next to impossible.

7. Negative energy related safety, environmental and health impacts of energy use and exploitation

The most prominent problems of pollution, greenhouse gas emissions and deforestation, arise from use of coal, oil spillage and the unsustainable harvesting of fuel wood by fuel wood vendors who sell the wood in urban settlements and to some Government institutions.

8. Weak energy trade and international cooperation compromising energy security and leading to increased energy costs

Botswana has not been able to exploit the regional market by concentrating energy trade almost exclusively on South Africa to the exclusion of the other SADC countries. The government is developing alternate routes and sources of modern energy products and services.

9. Inefficient service delivery and utilization of energy sources in all sectors for economy

Despite the urgent need for energy efficiency and demand side management (DSM) in light of the current supply deficit, there is no viable DSM program due to a number of factors that include inappropriate pricing in electricity and petroleum fuels, inadequate

awareness, lack of requisite skills for energy efficiency and lack of capacity to ensure implementation of standards for equipment and buildings.

10. Ineffective energy related research and development programs

There is inadequate energy related research and development (R&D). Linkages between researchers and policy makers are weak and there are no formal mechanisms for the parties to interact. Information flow between research institutions, policy makers and the public needs to be improved.

11. Ineffective private sector participation and low investment in the energy sector

Private sector participation in Botswana's energy sector has been low profile. Possible reasons for this include lack of clear policy and incentives and the absence of an impartial regulator to provide a level playing field for the sector.

12. Gender, age and socio-economic status are not taken into consideration in formulating energy policies and programs

Policies have been found to be 'gender blind' i.e. not taking gender differences in energy needs into account when formulating policies and programs.

Goals of the Energy Policy

The goals of the National Energy Policy express the desired end state, which must obtain when the policy has been implemented. The following policy goals were identified by the stakeholders:

1. Improved security and reliability of energy supply to all sectors of the economy;
2. Increased and equitable access to affordable energy services for all sectors of the economy, particularly the low income and marginalized;
3. Energy contributing to socio-economic development and social wellbeing of all the people of Botswana;
4. Effective institutional arrangement and governance for the energy sector;
5. Improved capacity for service delivery for all key stakeholders in the energy delivery chain;
6. Improved availability of energy information for policy and planning;
7. Minimized energy related environmental, safety and health impacts;
8. Strengthened energy trade and cooperation for enhanced energy security and reduction in costs;
9. Improved energy efficiency for all energy sources in all sectors for economy, increased security and environmental protection;
10. An effective and sustainable energy research and development program that addresses the country's energy development priorities;
11. Effective private sector participation and investment at all levels in the energy sector; and
12. Gender, age and socio-economic status are mainstreamed in all energy policies and programs.

1.0 INTRODUCTION

1.1 Overview of the Energy Sector

The Ministry of Minerals Energy and Water Resources through the Energy Affairs Department is responsible for the formulation, direction and coordination of the national energy policy. The overall policy goal for the energy sector is to provide affordable, environmentally friendly and sustainable energy services in order to promote social and economic development.

The energy policy strives to facilitate the provision of energy services at least cost to the economy as well as improve service delivery to meet customer needs. There is need to promote the use of locally available sources of energy to reduce reliance on imported energy sources as well as to encourage energy users to practice energy conservation and saving measures in all sectors of the economy.

Botswana has limited energy resources and therefore relies on imported energy sources especially petroleum products and electricity. However, the country has abundant coal reserves and is blessed with one of the best solar regimes in the world. There is need to promote the use of indigenous energy resources such as coal and solar energy to reduce dependence on imported energy sources.

The energy sector in Botswana comprises both conventional and non-conventional energy sources with the conventional dominated by electricity, petroleum products and coal whereas the latter is mainly biomass, in the form of fuel wood.

Since the beginning of the National Development Plan 8, Botswana has adopted the integrated energy planning concept that aims for the least cost development for the energy sector and focuses on customer requirements as opposed to the supply sector. This management approach will continue to be used to facilitate optimal efficiency of the sector.

1.2 Energy and Socio-economic Development

The provision of energy services is an essential ingredient of socio-economic development. Energy is required in meeting the basic human needs such as food, shelter, health, education etc; and for economic activities such as transport, manufacturing and mining.

The biggest challenge for the Government of Botswana is to extend access to commercial energy services to the people who do not have it. The constraint in extending access to commercial energy has not been limited by the availability of energy resources themselves but by the complex interplay of policies, markets and technology.

1.3 The Rationale for an Energy Policy Paper

Over the years the Botswana Energy Master Plan (BEMP) and successive National Development Plans (NDPs) have guided developments in the energy sector. Since the formulation of the Botswana Energy Master Plan in 1985 and its subsequent review in 1996, a lot has evolved within the energy sector resulting in new domestic and global challenges for the sector. The energy sector is now facing challenges that require policies and strategies that can facilitate effective and efficient management of the sector. Such challenges include: the need to increase access to modern energy services in rural areas,

improving energy service delivery, affordability of energy services especially to low income groups, exposure to high imports of electricity, potential supply disruptions of petroleum products, promoting the use of locally available energy sources, sustainable development and environmental protection.

It is therefore imperative that a policy paper is developed in order to address the challenges and provide direction for future developments in the energy sector.

Policy may be defined as “A definite course or method of action selected (e.g. by government or institution) from among alternatives and in the light of given conditions to guide and, usually, to determine present and future decisions’.

A national energy policy reflects what choices/decisions the nation is making from a number of alternatives to address particular energy related problems. Policy is public, not only because it is adopted and implemented by a Government, but also because it affects the public and it is visible to the public.

This National Energy Policy Paper is a promise by the Government of Botswana to its citizens that it will take a certain course of action and follow specific principles. Through the national energy policy statement, Government also informs its citizens and the international community at large of its priorities and direction in the energy sector. The policy statement should answer some of the questions prospective investors might have such as on priority areas, regulation and institutional arrangements in the sector. Energy researchers would also know what the priorities for energy research are, etc.

1.3 The process adopted in coming up with the policy

The process of an energy policy formulation requires participation of the stakeholders comprising of government policy makers and planners, energy suppliers and end users.

The current energy policy formulation process involved over 300 stakeholders representing 52 organisations, producers and users of energy; special interest groups in energy efficiency, electricity and biomass, traditional leaders and private citizens. The stakeholders included representatives from Government, parastatals, from private sector entities and most importantly grassroots people representatives at the three kgotla meetings. The thematic consultations were done along the themes: Access to Energy Services, Market Mechanism and Resources and Supply. The Market Mechanism Task Force held three separate workshops, with Government representatives, Financial Institutions and private companies (energy suppliers and retailers), respectively. The Resource and Supply Task Force also held three separate workshops, one each with Government representatives, Financial Institutions and private entities, respectively. The Access to Energy Services Task Force held five separate workshops, one each with Government representatives, energy suppliers, respectively and three kgotla meetings held at Mookane, Old Naledi and Metlobo Village. The identification of policy issues was in the form of consultations with individual stakeholders. The issues identified were discussed in the mini workshops involving key stakeholders from relevant energy sub-sectors. The mini-workshops also assisted in the definition of policy goals and measures. The consolidation of key policy issues and goals was discussed at the National Consolidation Workshop involving over 77 key energy stakeholders comprising representatives from government, industry and end users.

This Policy document was produced from a synthesis of the various stakeholder inputs at the consultative meetings and workshops, the Draft Energy Policy of 2006, existing literature on the energy sector in Botswana, including the Energy Chapter of the National Development Plan (NDP 10), the Biomass Energy Strategy and the Botswana Energy Master Plan (2004) and the Feasibility Report on the Production and Use of Biofuels in Botswana.

1.4 Conceptual Approach

Policy provides a general direction towards achieving given national goals or objectives.

The overall goal or aspiration for national socio-economic development for Botswana is given by Vision 2016. Therefore, all sectoral policies (energy policy included) must aim towards and contribute to the attainment of Vision 2016.

In formulating the National Energy Policy goals a situational analysis which gives us the current position or where we stand now was done. Policy must provide the bridge between the current situation and the desired or aspired position as given in Vision 2016. Each policy objective or goal should address (an) identified constraint(s) or an issue identified during the situational analysis.

1.5 Structure of the National Energy Policy Document

The Policy Document has seven sections and an Executive Summary.

- ✓ Section 1 is the Introduction which covers the role of energy in socio-economic development; the need for an energy policy and the process and conceptual approach taken in developing the current policy document.
- ✓ Section 2 gives the context (national, regional and international) within which the policy is being formulated.
- ✓ Section 3 covers the Goals and Objectives of the National Energy Policy.
- ✓ Section 4 gives a situational analysis and covers such topics as the socio-economic situation of the country, the energy sector and energy supply and utilization pattern.
- ✓ In section 5, the policy issues and challenges that the policy should address are identified and elucidated.
- ✓ Section 6 outlines the energy policy goals that must be achieved to address the issues identified in section 5.
- ✓ Section 7, outlines the way forward regarding the necessary Government approval process.

2.0 BACKGROUND AND CONTEXT OF THE NATIONAL ENERGY POLICY

The energy policy must be informed by the country's development priorities, regional and international realities.

2.1 National Context

The national energy policy must contribute towards the country's developmental aspirations which currently are encapsulated in the country's Vision 2016 and NDP 10.

Vision 2016 places emphasis on seven critical aspects which are:

- Education and information;
- Prosperity, productivity and innovation;

- Compassion, justice and caring;
- Safety and security;
- Democracy, transparency and accountability;
- Morality and tolerance; and
- Unity and pride.

(Source: BEMP 2004)

The policy must also address the country's problems such as poverty, poor access to commercial energy. The majority of the population in Botswana still depends on biomass as a source of energy while the country has abundant coal and solar energy resources.

As a national policy document, the National Energy Policy (NEP) will also need to be informed by and to influence other national policies such as transport, environment and industrial policies. NEP should not be just a passive recipient of the requirements of these other policies, but it should also influence them. Government will ensure that a two-way dialogue be established and maintained between energy planners and other sectoral policy makers/planners.

2.2 Regional and International Context of the NEP

NEP must be in harmony with, and should not contradict those policies that Botswana has adopted as a result of its membership to regional and international organizations. NEP must also recognize and take into account the external environment.

2.2.1 Regional Context

Botswana is a member of SADC and the Southern African Customs Union (SACU). Through the SADC Energy Protocol, Member States are required to work towards regional integration and cooperation in energy development. This requires that Botswana harmonizes her energy policy and programs with the rest of the region. For example, through the Southern African Power Pool (SAPP) member states trade in electricity through an interconnected electricity network. There are current efforts to develop new regional power cooperation through the Western Corridor (WESTCOR) Project. Other areas of regional cooperation include the Regional Petroleum and Gas Association (REPGA) approved by SADC in 2002 but yet to be operationalised.

In the area of energy research, the Botswana Technology Centre has signed a cooperation agreement with Regional Research Alliance (RRA), the Scientific and Industrial Research and Development Centre (SIRDC) of Zimbabwe and the Council for Scientific and Industrial Research of South Africa. The main objectives of this cooperation are to promote, pursue and implement projects with high regional impact, relevance and benefit to people of the region, to create synergy by pooling resources, to develop regional knowledge networks and enhance regional capabilities through human resource development and sharing of best practices.

A Regional Electricity Regulators Association (RERA) has also been established to coordinate and harmonize regulation in the energy sector. As Botswana develops its regulatory framework for the energy sector it will have to take this into consideration.

2.2.2 International Context

On the international scene, the policy is influenced by the volatile oil prices and insecurity of fuel supplies caused by instability in the Middle East and Persian Gulf.

Technologies such as coal-to-liquids and biofuels which reduce dependence on petroleum fuels are gaining prominence. The international environmental debate is dominated by the need to address the issue of global warming caused mainly by greenhouse gas emissions from energy related activities such as the burning of fossil fuels (coal, petroleum). This has resulted in increased efforts to promote the use of renewable energies and to increase energy efficiency. Botswana, together with many other countries, has ratified the Kyoto Protocol. Through these treaties, Botswana binds itself to formulate and implement policies that protect the environment.

Article 17 of the Kyoto Protocol defines carbon emissions trading and gives the rules and guidelines for verification, reporting and accountability for emissions trading which provides an opportunity for Botswana as a non-Annex B country to access funds and technology for its own developmental programs that meet the criteria set.

The Millennium Development Goals (MDGs) are also an important reference point for the country's aspirations for sustainable development. Energy is an essential input to the achievement of the MDGs.

The policy will also recognize and take into account current trends towards globalization and international energy trade.

3.0 GOAL AND OBJECTIVES OF THE NATIONAL ENERGY POLICY

In line with and supporting the country's Vision 2016, the vision for the energy policy is to ensure following scenario obtains for the country:

- Secure, safe, sustainable and reliable energy supply for social and economic activities for all sectors of the economy and for the disadvantaged segment of society;
- Information on energy readily available;
- Active participation by the private sector including local citizens and robust investment in the energy sector by the private sector;
- Equitable, transparent and consultative regulatory system that is people-sensitive and promotes efficiency and accountability; and
- Energy related research and development programs that address the country's development needs.

3.1 The Goal of the National Energy Policy

The overall goal of the National Energy Policy is to meet the energy needs of Botswana for social and economic development in a sustainable manner. Here sustainability is used in its broadest sense to include elements of economic, social, efficiency and environmental sustainability.

3.2 The Objectives of the National Energy Policy

The objectives that the National Energy Policy will pursue can be summarized as follows:

3.2.1 Increasing access to affordable energy services to all sectors of the economy

Increasing access to affordable energy services to all sectors of the economy is aimed at bringing about equity between all sectors of the population (rural or urban, rich or poor) and thus contribute to the economic growth of the country as a whole. To make energy affordable to the poor, Government accepts to shoulder the responsibility to absorb some of the sunk costs of energy infrastructure needed to serve the poor; promote rural electrification and decentralized renewable energy systems for rural areas and build capacity of local communities to manage some of their energy programs.

This will involve among other things:

- Cluster villages to maximize on economies of scale;
- Taking appropriate measures to make coal, LPG and other petroleum fuels accessible and affordable to the low income; and
- Promoting fuel wood management practices;

3.2.2 Stimulating sustainable economic growth by promoting competition, efficiency and investment in the sector and thus achieve poverty reduction.

This is to make sure that energy services are supplied at least cost to the economy with the energy supply industry operating efficiently and consumers in all sectors of the economy using energy efficiently and in a conservative manner. Only justified costs should be passed on to the consumer. Having many players in the sector will help promote efficiency through competition. The promotion of income generating activities will ensure that the availability of energy not only improves the quality of life of the people but also contributes to economic activity.

3.2.3 Improving institutional arrangements and governance in the energy sector

There is need to clarify the roles of the various players in the energy sector especially the role of the private sector. Policy making, regulating and implementation roles need to be separated. An impartial regulator for the sector should be introduced in order to create a level playing field for all in the sector. The regulator should be given the responsibility for setting standards, the 'rules of the game' and setting tariffs.

3.2.4 Improving capacity in the various players in the energy development and delivery chain.

The capacity for the various players in the energy delivery chain should be improved through training and giving them adequate resources to enable them to effectively play their role. For the Energy Affairs Division, there is need to upgrade their status to a Department and give them more resources to implement their various programs. They need training in Integrated Energy Planning. Grassroots communities need to be empowered through appropriate training to enable them play a meaningful role in development programs that affect them.

3.2.5 Improving the availability of energy information.

Energy related information for planning and policy is lacking and one of the objectives of this energy policy is to ensure that through surveys and research adequate information is gathered or generated and a comprehensive energy data base is created. Available information should be publicised through appropriate media and Government campaigns.

3.2.6 Managing energy related environmental and health impacts

Apart from promoting cleaner and more efficient energy technologies, environmental impact assessment of big energy projects will be required. To reduce deforestation from unsustainable harvesting of fuel wood, Government institutes currently using fuel wood will be encouraged to switch to either electricity or coal or gas (LPG) for cooking.

3.2.7 Improving energy security through diversity in supply and through regional cooperation and energy trade

Energy security must be improved through developing alternative petroleum fuels supply routes in addition to current ones from and through South Africa and electricity supplies from WESTCOR in addition to SAPP supplies.

3.2.8 Mainstreaming gender, age and socio-economic considerations in energy planning and development

As the energy needs are different depending on gender, age and socio-economic status there is need to take these differences into consideration during policy and program formulation and implementation.

4.0 SITUATIONAL ANALYSIS

4.1 General

Botswana is a land locked country with a land area of 582 000 km² and a population of 1.8 million people. This gives the country a gross population density of 3 people per km². However most of the population is concentrated in the South East and Eastern part of the country where the capital city, Gaborone, is located. The rest of the country is very sparsely populated posing serious problems in the distribution of economic activities and benefits to the rest of the population because of the huge distances involved. 58% of the population lives in urban areas and there is a steady increase in the rural-urban migration. Thus while in 1981 the percentage of rural population was 80.8% it currently stands at 42%.

4.2 Socio-economic situation

Botswana has a stable and robust economy open to external investment and trade. Inflation is low and stable and the current foreign reserves are healthy. The economy has traditionally been dominated by mining (diamonds) and one of the Government's focus drives for Vision 2016 is diversifying the economy with potential growth envisaged in manufacturing, tourism and financial services. Agriculture is also an important sector especially as a large proportion of the population derives its livelihood from agriculture. The Government is committed to poverty reduction and to combating the HIV/AIDS pandemic.

Vision 2016 has set a target economic growth rate of 8% per annum. If energy supply is not to be a constraint to this target growth, then the right policies and strategies must be put in place and implemented without delay.

4.3 Institutional Framework

The Ministry of Minerals, Energy and Water Resources (MMEWR), through the Energy Affairs Division (EAD) has overall responsibility for the energy sector in Botswana. Its mandate includes formulation, direction and coordination of the national energy policy and supervision of energy parastatal, the Botswana Power Corporation. The Ministry is also responsible for promotion of renewable energy technologies such as solar energy and biogas. Through the various units, the EAD is also responsible for promoting energy efficiency, wider coal utilization as well as increasing access to electricity to both rural and urban populations and long term energy planning of the energy sector.

In the petroleum sub-sector, several local subsidiaries of the multinational oil companies and indigenous oil companies are responsible for direct procurement, transportation, distribution and retailing of petroleum fuels. Petroleum fuel prices are determined through a Committee that includes the MMEWR. The Botswana Power Cooperation (BPC), a parastatal under MMEWR is responsible for electricity generation, transmission, distribution and supply. Electricity tariffs are also set by the MMEWR.

Other organizations involved with the energy sector include:

- The Ministry of Environment, Wildlife and Tourism which is responsible for forestry and environmental conservation.
- The Forestry Association of Botswana (FAB) carries out long term research on fuel wood, productivity of natural woodlands, promotion and implementation of fuel wood programs.
- The Ministries of Local Government and Education are responsible for off grid power supply and installation and maintenance of solar energy equipment in government institutions in rural and urban areas.
- The Rural Industries Innovation Centre (RIIC) is responsible for developing, testing and dissemination of renewable energy technologies.
- The Botswana Technology Centre (BOTECH) undertakes research and development and information dissemination on solar energy. Research and training institutions in general provide support in identification and development of appropriate technologies and trained personnel to design, install and maintain equipment.

4.4 Energy Resource Base

Botswana's energy resource base is dominated by huge coal reserves estimated at 212 billion tons. Only the Morupule Colliery is currently operational. The resource and economic potential for coal bed methane (CBM) is still to be established, although estimates put the CBM resource potential at roughly 35 terra cubic feet (TCF). There are two companies (Kalahari gas and Saber) doing explorations. The CBM is targeted for power generation.

Botswana has no known petroleum reserves and the country has to import all its petroleum products requirements in refined form, mainly from South Africa.

The woody biomass loading ranges from 3.6 to 4.3 tons per ha per annum for shrub savannah to 4.8 to 10.6 tons per ha per annum for dense forest.

The mean annual solar insolation is 21 MJ per m² per day, one of the highest radiation levels in the world.

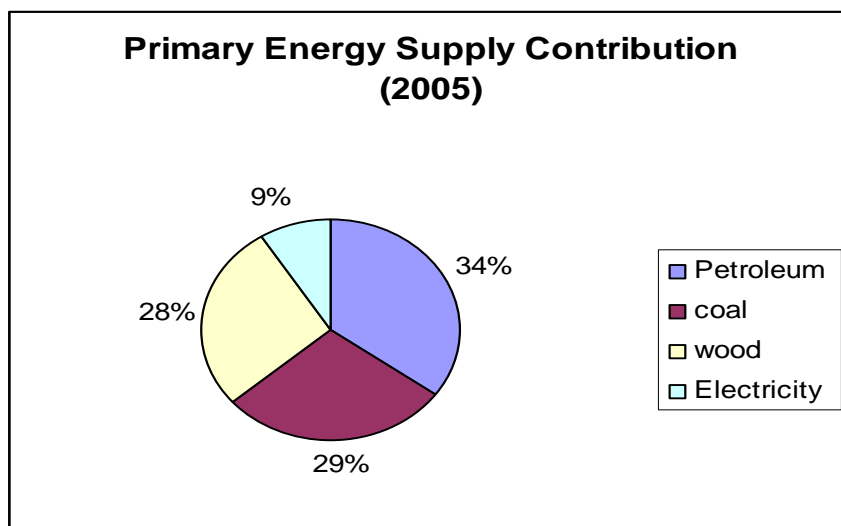
Average wind speeds range from 2.0 to 3.5 m/s, considered too low for viable wind based power generation, but reasonable for water pumping. Wind pump technology is, however, not widely used in Botswana.

A feasibility study on biofuels production and use in Botswana established that there was potential for biofuels mainly ethanol based on sorghum and sugar cane feedstock and biodiesel from jatropha. Government support in the form of tax and levy exemption would however be required for these options to be viable. Other issues to be addressed include research into feedstock crops, and operation and maintenance of production equipment as well as establishment of appropriate institutional framework for the promotion of biofuels.

With a large cattle population, the potential for biogas should be huge. However, because most of the cattle are free range, this potential cannot be realized except at slaughter houses and dairies. There is also potential for producing energy from municipal solid waste of about 16.9 million tons per year and from waste water treatment plants.

4.5 Energy Utilization Pattern

According to the 2005 figures, petroleum products contribute the largest share of the primary energy supply (35.1%) followed by coal (28.6%), wood 27.5%) electricity 8.8%, with the contribution of renewable energy being insignificant. Net energy supply and final consumption is dominated by petroleum products (66%) followed by electricity (20.66%) and coal (12.95%). The transport sector consumes most of the country's energy (60%), followed by mining and quarrying (18%) and the Residential sector (8%). Service sector consumes 7% while agriculture consumes only 2 % (see pie chart below).



Primary Energy Supply
Source: EAD

4.6. Energy Planning

Botswana has adopted the integrated Energy Planning (IEP) framework to guide the energy sector. IEP is a planning process which aims for a least-cost development path for the energy sector to guide policy-making and implementation.

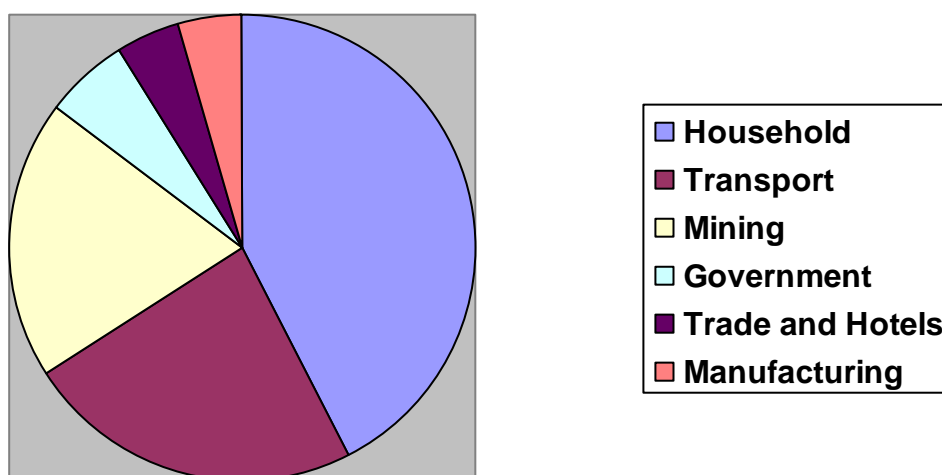
EAD is currently undertaking a four-year (2007 – 2010) project with the International Atomic Energy Agency (IAEA) to strengthen the division’s planning capabilities and transferring IAEA planning tools to EAD. Current problems with implementation of IEP include lack of adequate data on energy supply and demand especially for non-commercial energy like fuel wood; inadequate capacity within EAD to implement IEP due to high staff turnover and regulatory shortcomings resulting in EAD being unable to get relevant data from stakeholders. The EAD does not have legal powers to enforce submission of data from energy suppliers and users.

4.7 Energy Demand Side

When all the energy sources are considered, households take the largest share of energy use in Botswana. However, when fuel wood is excluded transport takes the lead.

Table 1. Energy Demand – All Energy Sources

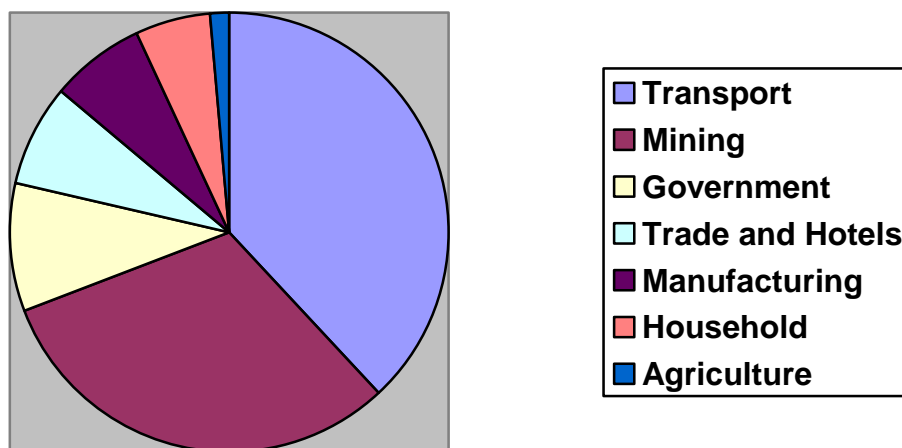
Sub-Sector	%
Household	42.0
Transport	23.3
Mining	19.10
Government	5.8
Trade and Hotels	4.5
Manufacturing	4.3



Overall Energy Demand: Source BEMP 2004

Table 2. Commercial Energy (Excluding Fuel wood)

Sub-Sector	%
Transport	38.0
Mining	31.2
Government	9.5
Trade and Hotels	7.3
Manufacturing	7.0
Household	5.5
Agriculture	1.5



Commercial Energy Demand (Excluding Fuel wood): Source BEMP 2004

4.7.1 Household Sub sector

The energy of choice for households depends on income levels. High income (>P8000/month) households tend to use electricity whereas lower income households tend to use paraffin and fuel wood. LPG use in urban Botswana is becoming prevalent. Urban households that depend on electricity pay more for energy than those who depend on other energy sources. Studies also show that households use a multiple of energy sources, even for one end use, depending on availability of both the energy source and money to purchase the fuel. However, the households are not always able to make informed decisions on least-cost mix of energy sources for the various end uses due to lack of relevant information.

Energy expenditure in the lowest income urban households is around 20% of household income. This represents a significant burden for such urban households.

The majority of rural households and low income groups in rural areas cannot afford the initial costs of wiring or buying materials for electricity provision even in areas where electricity is available, and fuel wood dominates energy consumption in rural areas at the domestic level. Paraffin is the main fuel used for lighting.

Despite Government's promotional initiatives, the rate of rural electricity connections is below target. This could be because the initial cost of connections and appliances is not affordable to the majority of rural households. To alleviate the problems associated with house wiring costs, the BPC has introduced the 'ready board', which makes extensive wiring unnecessary.

The low population densities and the spread of villages over wide areas also make electricity provision through grid extension costly and unviable for BPC.

4.7.2 The Transport, Manufacturing, Mining and Agriculture Sub-sectors

The transport sector in Botswana relies solely on petroleum fuels. All rail traction is diesel powered and accounts for some 10% of diesel usage in the transport sector. Petroleum products account for 100% of the energy supply for road and air transport (BEMP 2004).

The transport sub-sector poses significant environmental impacts (e.g. vehicular emissions, oil spillage and greenhouse gas emissions) from fuel transportation, storage handling and use, as well as social impacts (e.g. accidents, traffic congestion) (BEMP 2004). Because Botswana is a sparsely populated country in general, the distribution of transport fuels throughout the country especially to outlying rural areas is challenging.

The mining sector is the largest consumer of electricity in the country and is the second largest consumer of coal after power generation. However, as the country diversifies its economy in line with NDP10 and Vision 2016, the demand profile for electricity is expected to shift, with manufacturing gaining a bigger share of electricity.

4.7.3 Commerce and Government

The Trade and Hotels sub-sector depends mainly on coal and electricity while the Government sub-sector consumes mainly petroleum products and electricity. After Mining, Trade and Hotels and the Government are the next largest electricity consumers, presenting an opportunity for demand side management or energy efficiency measures involving electricity.

The consumption of coal in this sub-sector is minimal, despite the fact that the consumption of wood fuel is undesirably high e.g. the use of fuel wood by police camps and schools.

4.8 The Supply Side

4.8.1 Electricity

Electricity generation in Botswana is dominated by the BPC, a parastatal which operates the 120 MW coal fired power station at Morupule. With the national maximum demand of 500 MW, Botswana has to import almost 80% of its power requirement from the Southern African Power Pool (SAPP), mostly South Africa. As the Southern African region is currently experiencing a power generation deficit, the need for Botswana to augment

internal generation cannot be overemphasized. This is being pursued through the planned Morupule Power Station Expansion project which will add an extra 600 MW by 2011 and a project to tap into the Western Corridor (WESTCOR). A 2400 MW coal fired Mmamabula Coal Fired Power Station (Independent Power Producer) is planned for later. The Electricity Supply Act is being amended to allow private sector participation in power generation.

The power sector policy planning criterion has had to be changed from 'least cost' in NDP 9 to internal 'self sufficiency' in the light of the regional power deficit. Despite allowing for private sector participation in power generation, Government has retained control over electricity tariffs through the MMEWR. BPC is the sole supplier and distributor of electricity. BPC's tariff applications have not only been experiencing delays in getting approvals, the tariff level finally approved has lagged behind the required tariff, resulting in marked decline in the financial performance of BPC starting with a positive return on assets of 5.3% in 2003/4 and steadily declining to a projected negative -9.11% in the 2008/9 financial year.

4.8.2 The Rural Electrification Program

There was an increase in access to electricity from 26% in 2004 to 49% in 2008 due to favourable terms introduced for the rural electrification program. However there was no financial provision for the program in the financial years 2004/5 and 2005/6. There is need for a more sustained funding mechanism.

The Government and BPC have also explored non-grid electrification which includes solar electric systems, rechargeable lanterns, solar recharging stations and solar PV mini-grid. A 100 villages' electrification project is being implemented with funding from the Swedish Government. The project is expected to be complete by 2010.

To facilitate access to electricity, the Government has also introduced flexible payment terms.

4.8.3 Restructuring the Electricity Supply Industry (ESI)

A study commissioned by the Government of Botswana on possible restructuring of the ESI proposed four alternative strategies:

- *Public Governance through which the governance of BPC would be strengthened through a performance compact with Government;*
- *Privatization of BPC, in which the majority shareholding of BPC would be sold;*
- *Private generation in which only the generation assets of BPC would be privatized, and private capital would be used for Morupule extension. BPC Transmission & Distribution would remain in Government hands as a single buyer; and*
- *Competition, which would be introduced at wholesale level, allowing large consumers to select their own supplier.*

(MMEWR 2003)

The Consultants recommended the combination strategy in which Private Generation will be introduced. BPC would be restructured along strategic business units. A performance compact would be negotiated with Government. A regulatory authority would be established. Government is still investigating the best option, which includes the establishment of a multi-sectoral regulator.

4.9 Petroleum Fuels Sub-sector

A few supply hiccups arising from the limited regional supply capacity, distribution bottlenecks and limited internal storage highlighted the need for strategic reserves. The Government has commissioned a study on the best way to cater for strategic reserves and has investigated the feasibility of an oil pipeline to bring product into the country. The sparse population distribution in rural areas poses challenges for product distribution to these far flung areas.

Petroleum prices continue to be controlled by Government. The depletion of the National Petroleum Fund indicates that the prices awarded to traders tend to lag behind the real costs of supply. One challenge that still needs to be addressed adequately is meaningful participation of citizens in the petroleum industry in procurement and distribution which are currently still dominated by subsidiaries of multinational oil companies.

4.10 Coal

The Government of Botswana has had interest to develop and promote wider use of coal to substitute for imported energy and to replace fuel wood for domestic and institutional use because of the abundant coal reserves in the country. The coal is of varied quality. The texture of some types of Botswana coal is such that, unless the coal is beneficiated first, it is unsuitable for making briquettes which can be used as a domestic fuel. Some of the coal also has too high content of volatile matter and has a tendency to produce too much smoke.

A coal utilization study in 1985 concluded that the coal was suitable for beneficiation and that there was a market for beneficiated coal. Beneficiation improves the quality of the coal by reducing the ash and sulphur content. A reliable transport, an appropriate pricing mechanism, a coal use education program and a suitable and affordable coal stove were major issues to be addressed. A major constraint for wider use of coal is its affordability to consumers, especially the targeted current fuel wood users. Subsidizing coal is an option Government can consider. Currently Government (EAD) is not involved in coal pricing. Localities that have the greatest potential for fuelwood conversion to coal are those along the railway line.

4.11 Biomass

Biomass continues to be a major source of energy for rural and low income urban communities. The advent of trade in fuel wood has seen the indiscriminate cutting down of live trees. Fuel wood is now scarce in all areas of the country except in the North like Komana, Toteng and Sehitwa. Previous efforts to augment fuel wood stocks through afforestation have not been very successful as there was no incentive for the communities to manage them. (EAD)

Generally, biomass activities have been fragmented in Government institutions and Non Governmental Organizations (NGOs). Efforts to introduce more efficient wood stoves have not been very successful partly due to the inability of the target groups to afford the stoves. Some success has been recorded in areas of severe wood shortages.

A Biomass Energy Strategy (BEST) is currently being formulated to find the most sustainable way of meeting the country's biomass energy requirements.

4.12 Biofuels

The feasibility study to establish the potential for biofuels as a source of fuel for Botswana has been completed. The study has established that:

- Botswana has a potential to produce biofuels (biodiesel from *Jatropha* seeds, ethanol from sweet sorghum and bio-gel);
- Government assistance in the form of subsidies is required to make these initiatives attractive; and
- More research work is required on the feedstock.

4.13 Other New and Renewable Sources of Energy (NRSE)

Besides coal and biomass Botswana is well endowed with solar energy resources. There are over 3,200 hours of sunshine per year, cloudy days are relatively few; on average there are over 300 days of sunshine annually. The mean annual solar insolation is 21 MJ per m² per day, one of the highest radiation levels in the world. This offers excellent conditions for solar energy applications. The Long Term Vision for Botswana (Vision 2016) recognizes the potential role that solar energy can play in meeting the energy requirements of rural communities not served by the national grid and recommends that Botswana should be developed into a centre of excellence for solar energy technology.

Despite their potential, solar energy technologies face a number of barriers that have inhibited their wide spread dissemination. These include:

- i) High initial investment cost;
- ii) Poor or sub-standard installations;
- iii) Lack of awareness;
- iv) Lack of mature or well developed industry;
- v) Lack of conducive legal and policy framework for growth of renewable energy; and
- vi) Inadequate trained personnel to design, install and maintain systems.

There is need for coordinated effort to promote NRSE by various key organizations dealing with NRSE particularly solar- among them BOTEK and RIIC. BPC has been identified as the most suitable institution to implement solar electrification in view of their mandate to provide electricity to rural areas irrespective of the source.

Recent studies under the PV Master Plan Study and evaluation of the National Photovoltaic Rural Electrification Programme (NPVREP) have concluded that NRSE, solar PV and Solar Water Heaters (SWH's) in particular will only succeed with government support in the form of subsidy or appropriate incentives.

Botswana's vision to be a centre of excellence in solar technologies has to be translated into reality. This will require mapping out areas where Botswana could use its comparative advantage taking into account the role that both public and private sector can play in promoting the vision.

Whilst current emphasis is rightly placed on solar energy in Botswana, exploration of the potential of other NRSE such as biogas/land fill is still lagging. These energy sources are increasingly becoming popular globally, as they offer sustainable energy solutions.

4.14 Energy Research and Development

Because the energy sector is both technological and capital intensive in nature the need to promote healthy interaction between researchers and policy makers in Botswana cannot be overemphasized. In addition to technological research there is also need to carry out relevant policy related sociological and market research which is required for the formulation of relevant policies.

Secondly, given the increasing cost of fuel as a source of energy, there is also a need to intensify research towards finding alternative energy sources such as biofuels, coal-to-liquids and other cleaner coal technologies. More collaboration is needed between researchers and policy makers in finding solutions to the present problems inhibiting the effective and efficient utilization of solar energy and wind in the country and to develop technologies for more efficient energy utilization. The possibility of using wind-propelled energy also calls for an increased collaboration between relevant researchers at the University of Botswana Engineering Faculty, and policy makers.

The Ministry of Communications, Science and technology sets the policy and agenda for all research in the country. Energy related research is done at the Botswana Technology Centre and the University of Botswana. FAB carries out long term research on fuel wood, productivity of natural woodlands and in promotion and implementation of fuel wood programs.

4.14 Energy Efficiency

Although energy efficiency is still low profile in Botswana, the Government through the EAD and BPC is trying to raise awareness for energy efficiency through leaflets and flyers encouraging people to switch off unnecessary loads and encouraging the adoption of efficient compact fluorescent lights. The motivation for energy efficiency derives from the high energy import bill and the current power deficit in the SADC region.

A national energy efficiency strategy is currently being formulated with assistance from a donor. As part of this exercise building regulations related to energy efficiency are also being developed. The building regulations are meant to *'provide buildings and their services which are capable of using energy efficiently throughout their life'*.

4.15 Energy and Gender

The main findings of a gender audit aimed at identifying gender gaps in energy and poverty policies and making gender and energy issues more visible which was undertaken in Botswana in 2006 were:

- Female headed households have lower incomes than male headed households in both rural and urban areas. This has a significant impact on affordability of energy services.
- There are more female headed households below the poverty line than male headed households.
- Females are the ones most involved in fuel wood collection and they spend long hours in this drudgery.
- More male headed households are connected to electricity and take loans for solar photovoltaic equipment than female headed ones.
- The number of female professionals in energy related organizations is negligible (<5%).

- There is limited knowledge by officials in energy related organizations about gender and the relationship between energy, gender and poverty.

5.0 CONSOLIDATED ISSUES

From the foregoing background and the consultations done with stakeholders, the following main issues have to be addressed for Botswana to meet her goals in energy provision.

5.1 Inadequate security and reliability of energy supply to all sectors of the economy

Botswana's energy situation is characterized by a very high dependence on imports. This costs the country heavily not only in terms of foreign currency outflows for energy imports but also in security and reliability of energy supply.

The country has to import all its petroleum requirements in refined form (costing the country billions of Pula per year) mostly from or through South Africa. This dependence on a single supply source and limited supply routes compromises the country's security of fuel supply as there can be transport bottlenecks on the limited routes bringing fuel into the country, as has already happened before.

This situation is further exacerbated by the limited internal petroleum fuels strategic reserve storage capacity which is currently way below the desirable 90-day supply level. Any supply disruption is likely to have an immediate negative impact on economic activity. Petroleum fuels supplies to other parts of the country are also hindered by the limited supply infrastructure such as road and rail and by the large distances involved which make delivery costs very high. The small consumption levels in these far-out places also make supplies uneconomic, discouraging any company from making deliveries thereto.

More work still needs to be done on the development of internal sources of fuel (such as biodiesel, ethanol and possibly coal-to-liquids) that could complement imports. Lack of support services e.g. agricultural extension support services for biofuels production could explain the slow development of these.

In recognition of these problems surrounding petroleum fuels supplies, the Government has instituted a petroleum fuels supply strategy study that looks at the best way of supplying the country with the requisite fuels

In the electricity sub-sector, BPC has to import almost 80% of its requirements (due to a generation shortfall) from the SAPP, mostly ESKOM of South Africa. As ESKOM itself is also failing to meet its own demand, supplies to BPC have had to be reduced. This puts pressure on BPC to augment internal generation and increase security of supply.

The rural areas, which depend largely on wood fuel to meet their energy needs for cooking and heating, are also experiencing fuel wood shortages in selected areas. Contributing to the energy insecurity situation in Botswana is the underutilization of abundant local energy resources such as coal and solar energy.

The high transportation costs and limited distribution infrastructure for coal because of the large distances involved to supply rural areas reduce the chances of this fuel being adopted in rural areas.

5.2 Poor access to affordable energy services for all sectors of the economy, particularly the low income and marginalized

Poor access to affordable energy to the low income is caused partly by the underutilization of local energy resources such as coal, and solar energy, the high cost of energy service vis-à-vis low income levels of the consumers and lack of appropriate technologies and appliances to address the energy needs of the poor. Deserving special mention is the lack of affordable solar appliances as well as coal burning appliances which could be used by the low income. Access to electricity for the poor in both rural and urban areas lags behind target because the poor cannot afford the costs of connection, wiring and the electrical appliances that are required for one to use electricity.

Since the majority of the poor live in rural areas far away from distribution infrastructure such as roads and rail, the distribution challenges surrounding these energy sources contribute to their being unavailable or unaffordable to the poor. For instance, for coal, the only areas where coal would be a viable and affordable substitute for fuel wood is in areas along or not very far from the railway line.

Fuel wood shortages are also being experienced in selected areas and the communities, who do not have affordable alternatives, have to walk long distances to collect fuel wood. The poor are also forced into unsustainable dependence on fuel wood because they cannot afford the prices of alternatives such as paraffin, LPG and solar energy. In some cases there is also lack of awareness of what alternatives are available their costs and the benefits that can be derived from these alternatives or lack of the necessary skills to exploit these alternatives by both rural development planners and the communities themselves. Those institutions involved in rural development tend to pursue sectoral or sometimes technology based programs without integrating all the possible alternatives. An example is rural electrification where grid based programs tend to be promoted to the exclusion of other decentralized approaches, thereby disadvantaging the rural poor.

5.3 Lack of energy hampering socio-economic development and causing social hardships to the people of Botswana

The shortage of energy in some parts of the country has been shown to hamper economic productivity and contribute to social hardships and poor quality of life. The time taken and the distances walked to collect firewood in wood deficit areas leave the affected communities with less time to concentrate on economic activities.

Areas without access to electricity cannot enjoy such essential services as medical refrigeration, street lighting and use of modern information communication technology (ICT).

5.4 Ineffective institutional arrangement and governance for the energy sector

Implementation of several Government programs has been hampered by the lack of clarity of roles between the various players in the energy sector, especially the role of the private sector and Government and bureaucratic processes that take long for decision to be made e.g. on pricing and investment. Private sector stakeholders complain of Government delays in decision making and on licensing.

There has also been inadequate coordination of key players in project delivery. The biomass sub-sector best illustrates the impact of uncoordinated effort between the many players (Energy, Forestry, Agriculture and Environment). This lack of coordination has resulted in fragmented efforts by the relevant institutions.

Government has retained control over prices and licensing in electricity and petroleum fuels. Energy prices have tended to lag behind market levels resulting in the deterioration in the financial performance of BPC and the depletion of the National Petroleum Fund.

The restructuring of the electricity supply industry and the establishment of a sector regulator are still to be implemented. Meanwhile, the EAD lacks the capacity for effective sector oversight due to resource and regulatory shortcomings.

5.5 Inadequate capacity for service delivery for key stakeholders in the energy delivery chain

Inadequate capacity of Government institutions to implement policy and program initiatives has also contributed to limited success in energy delivery. As an example, the EAD has adopted IEP approach but has not been able to implement it due to high staff turnover, lack of skills and lack of the necessary data for IEP. EAD is also constrained by small staff complement and limited funding. Their status as a division also means that most decisions have to be made outside their department further reducing their capacity to deliver.

EAD also lack the necessary legislation to empower them to enforce policy decisions in their oversight of the energy sector. Lack of coordinated approach between the various players especially in rural development activities has resulted in diminished success in rural development programs like fuel wood where several players (Energy, Forestry, Agriculture and Environment) are involved.

The necessary skills to implement some programs particularly in renewable energy technologies and energy efficiency are absent in both entrepreneurs and Government officials. This explains in part, the low uptake of renewable energy technologies and the absence of any viable energy efficiency programs even under the current energy shortages.

5.6 Lack of energy information for policy, planning and decision making.

There is a dearth of data and information on energy resources and issues, especially on non-commercial energies like biomass, which makes planning and policy formulation next to impossible. The energy resource base has not been sufficiently assessed. This is particularly so for fuel wood. The coal resources have not been fully characterized and the resource and economic potential for coal bed methane have also not been established. Full exploitation of these resources cannot be realized unless their potential and characteristics are known.

There has been inadequate energy related research and development work which is necessary to generate new knowledge and develop appropriate technologies suitable for the local communities.

The end users and planners also lack awareness on resources and alternatives as well as on socio-economic aspects of energy development such as gender. Thus, policies tend to be gender blind, limiting the success of any programs planned without gender

consideration. Lack of awareness of the benefits of renewable energy by planners and communities has resulted in very few development programs that specifically target to exploit and make use of them.

The end-user also needs education on the advantages and viability of the various energy resources particularly renewable energy and on the costs of the different energies for a least cost energy mix to meet his energy needs. Often the end user is faced with choices between a number of options such as electricity, LPG, paraffin, coal and fuel wood.

Prospective investors do not have appropriate and properly packaged information for investment decisions. Whatever information they can get is scattered in different organizations and Government ministries.

As a signatory to three Kyoto Protocol, Botswana can participate in CDM programs but the country has not benefited from or taken advantage of these programs due to lack of knowledge and awareness on carbon credits on such programs as forestation by planners and decision makers. Through such programs Botswana can have access to energy efficiency technology.

There is limited information flow between entrepreneurs, Government and the general public.

5.7 Negative energy related safety, environmental and health impacts of energy use and exploitation

There is need to address the negative environmental impacts of energy use and exploitation such as deforestation, atmospheric and indoor pollution. The most prominent problem, deforestation, arises from the unsustainable harvesting of fuel wood by fuel wood vendors who sell the wood in urban settlements.

Botswana has low quality coal with limited utility without prior beneficiation. The coal has a high content of volatile matter and a tendency to produce too much smoke. In addition, the adverse environmental impacts of coal such as GHG emissions have to be addressed.

Charcoal production for commercial purposes, which has recently surfaced in Botswana, accompanied by the continued use of biomass by public institutions (such as schools and the police) leads to accelerated deforestation. Other environmental problems come from the transport sub-sector and include oil spills, the disposal of used oil and vehicular pollution.

5.8 Weak energy trade and international cooperation compromising energy security and leading to increased energy costs

As far as energy supply is concerned, Botswana tends to rely heavily on South Africa and less so on other SADC countries. All the country's petroleum fuels and about 80% of the country's electricity requirements are sourced from South Africa. Transport bottlenecks arising from the limited supply routes threaten security of supply.

There is a need for the country to diversify its energy sources and supply routes by developing more ties with the other countries in the region.

5.9 Inefficient service delivery and utilization of energy sources in all sectors for economy

Energy efficiency and demand side management have a potential to reduce the current energy shortages that Botswana is facing.

Inefficient utilization of energy such as the inefficient combustion of fuel wood resources by use of the open fire, result in resource wastage as well as environmental pollution. Certain cultural practices surrounding the use of the open fire that tends to hamper the adoption of more efficient energy technology such as the 'closed box' wood stoves.

Despite the urgent need for demand side management (DSM) in light of the current supply deficit, there is no viable DSM program due to a number of factors that include inappropriate pricing in electricity and petroleum fuels which does not send the correct signals to the consumer about the need to conserve; lack of awareness and appropriate skills for energy efficiency and lack of standards for equipment and buildings.

Lack of competition in the electricity sector is also seen as contributing to inefficiency and poor service delivery by the only player, BPC.

An Energy Efficiency Strategy for the country is being developed by the Energy Affairs Division of the Ministry of Minerals, Energy and Water Affairs (MMEWA) with assistance from a donor.

5.10 Ineffective energy related research and development programs

There is inadequate energy related research and development to address the energy needs of the country. Research is required to generate new knowledge and data for planning, policy and decision making; develop appropriate technologies and appliances such as solar and coal stoves to address the needs of the people and explore the potential of new coal technologies

Linkages between researchers and policy makers are weak and there are no formal mechanisms for the parties to interact. Information flow between research institutions, policy makers and the general public is weak.

5.11 Ineffective private sector participation and low investment in the energy sector

The private sector has taken a rather low profile in the energy sector in Botswana except in the petroleum sub-sector where, through subsidiaries of multinational oil companies, they are involved in the procurement, distribution and retailing of petroleum fuels.

Some of the factors responsible for this low profile of the private sector include the poor pricing mechanisms which result in uncompetitive prices that are not cost reflective and are not attractive to the private sector. This is especially so in electricity where, because of the highly capital intensive nature of the industry and the long lead times, an assurance of cost reflective tariffs is essential before one invests. Other barriers to private sector participation include the high investment risks in areas such as biofuels which not only have to compete against established fossil fuels but also rely on unpredictable factors such as rainfall and an undeveloped biofuels market. The volatility of the international oil

prices (which in 2008 alone saw prices rise from below US\$60 /barrel to over US\$140 /barrel and back to below US\$50 /barrel) also cast a shadow of uncertainty on the viability of biofuels in the near future without any Government support. The long gestation periods (3 to 5 years) in biofuels for the investments to start showing returns further discourage new investors in the absence of any targeted incentives by Government.

Biofuels also face competition for the limited arable land available for either food or energy crops. Botswana is a fairly small market by international standards and some prospective investors see the limited market opportunities as a deterrent. However, a focus on the SADC region as potential market should provide a better outlook.

The absence of an impartial regulator for the energy sector is also seen as a deterrent for effective private sector participation. The ESI has also to be restructured to allow for private sector participation and competition.

In the oil industry, there is unsatisfactory citizen participation as citizens have only been able to participate meaningfully at retail level and minimally in fuel procurement. Without Government support the citizens may not be able to break into the lucrative procurement business.

Other barriers to private sector participation include lack of information on investment opportunities and low skills base for both entrepreneurs and Government officials to promote investment.

5.12 Gender, age and socio-economic status are not taken into consideration in formulating energy policies and programs

An energy-and-gender audit done in Botswana found that the majority of women and children who bear the brunt of fuel wood use such as the drudgery of gathering the resource and exposure to indoor air pollution from open fires are not involved in policy formulation and technology development. As a result, their interests and concerns are not taken aboard during the policy formulation process. In addition, the number of female professionals in energy related organizations is negligible.

There is also inadequate disaggregated data for gender mainstreaming during planning and officials in energy related organizations have limited knowledge on gender and do not have gender analysis and mainstreaming skills. Policies have thus been found to be 'gender blind' i.e. not taking gender differences in energy needs into account when formulating policies and programs.

6.0 THE GOALS OF THE NATIONAL ENERGY POLICY

The goals of the National Energy Policy express the desired end state which must obtain when the policy has been implemented.

Goal 1. Improved security and reliability of energy supply to all sectors of the economy

Security of energy supply is achieved when energy is readily and reliably available to all sectors of the economy with minimal disruption. The high dependence on imported energy will be reduced by developing local energy resources where possible and economically attractive.

Security of petroleum fuel supplies to all market sectors is assured through improved internal strategic reserves to 90 days supply, diversified supply sources, routes and transportation modes including (if economically attractive) an oil pipeline; and when appropriate management plans for release and distribution of petroleum products have been put in place.

Security is also improved when biofuels and other alternative renewable energies (solar, biogas) have been promoted and the feasibility of coal-to-liquids explored in order to increase the contribution of local fuel sources. Support services such as agricultural extension for biofuels production will be developed.

For the coal sub-sector security of supply is improved through the development and operation of new coal mines and distribution networks in different parts of the country to widen the coal market and reduce the distribution costs.

The resource, technological and economic potential of coal bed methane in the country will be developed and the indigenous coal market expanded through appropriate pricing and investment incentives.

To enhance internal electricity generation, the Morupule Expansion and the Mmamabula project will be implemented and the operational efficiency of BPC improved through an effective performance management compact with Government.

Private sector participation in the energy sector will be enhanced through effective regulation and incentives.

DSM will be promoted and implemented in order to reduce effective load and for environmental protection through improved technical efficiency.

Research and Development in alternative energy technologies to increase the energy base will be promoted and opportunities under clean development mechanism and carbon trading will be explored and exploited where possible. Renewable energies will be integrated into national development programs including the rural electrification program.

Supporting infrastructure e.g. rail and road for distribution of coal and petroleum fuels will be improved and new supply routes explored in order to reduce the transport bottlenecks arising from limited supply routes which threaten security of supply. For the electricity sub-sector, more transmission lines will be constructed to support the rural electrification program.

Programs for fuel wood management will be developed and implemented to mitigate the fuel wood shortages in some rural areas of the country.

To improve supplies of petroleum fuels and other energy forms to rural areas Government will explore measures that can reduce transportation costs because of the large distances involved to supply these areas.

Goal 2. Increased and equitable access to affordable energy services for all sectors of the economy, particularly the low income and marginalized

To achieve increased and equitable access to affordable and efficient energy services, Government accepts to shoulder the responsibility to absorb some of the sunk costs of

energy infrastructure needed to serve the poor and the disadvantaged such as the capital costs of grid extension in rural electrification programs; subsidized renewable energy infrastructure and fuel distribution infrastructure in order to reduce the distribution challenges and the cost of energy to the low income. Government will, however, not subsidize consumption except in extreme cases in which lifeline support may be given.

High priority will be given to the development of infrastructure for delivery of energy services: roads, rail, pipeline; and promote decentralized integrated energy systems for rural areas where these are more attractive than grid extension to combat fuel wood shortages. Programs to raise awareness on the benefits of renewable energy for planners and communities will be launched. The current subsidized electrification programs will be stepped up to increase access to electricity in both rural and urban areas.

The capacity of local enterprises will be enhanced by training managers and other personnel to run the different aspects of business including project planning and formulation, accounting, construction and maintenance. Private sector participation in energy and infrastructure provision will be accelerated.

Appropriate technologies and appliances to address the energy needs of the poor will be developed in order to maximize the utilization of local energy resources. More research to make energy more affordable to the low income will be pursued.

Goal 3. Energy contributing to socio-economic development and social wellbeing of all the people of Botswana

Efficiency and improved quality of service in the energy sector will be developed through competition and performance standards to ensure that only justified costs are passed on to the consumer. The viability of service providers will be ensured by allowing cost reflective tariffs. Only targeted subsidies where these are justified on equity considerations will be implemented. Income generating activities (as opposed to merely consumptive use of energy) which improve the social wellbeing of the communities and enables them to pay for the energy and decentralized energy supply will be promoted.

The sustainability and viability of the Rural Electrification Program will be improved by linking it to productive and income generating activities such as irrigation to increase the load and enable the beneficiaries to pay for the power.

Goal 4. Effective institutional arrangement and governance for the energy sector

Government will clarify the roles of all the key players in energy delivery. The private sector will play a more prominent role in infrastructure and service delivery in a restructured energy industry.

An impartial regulator for the energy sector will be established through appropriate legislation. The regulator will establish performance and product standards and set cost reflective energy prices through appropriate regulations. More effective coordination of the various activities of the many players in the sector will be instituted.

Integrated development planning will be implemented in collaboration with other Government institutions in order to achieve synergy and effectiveness.

Regular consultations between Government and stakeholders will be intensified to encourage a two-way flow of information and thus improve coordination.

Goal 5. Improved capacity for service delivery for all key stakeholders in the energy delivery chain

Successful delivery of energy programs will depend on each key player in the energy delivery chain having the necessary capacity to play their role. Thus, the capacity for Government officials and entrepreneurs will be developed through appropriate training programs that give them the necessary skills and tools such as in integrated energy planning, policy analysis etc. The EAD will also be upgraded in status to enable them to take the necessary decisions and more resources will be allocated for their programs. Relevant legislation will be passed to enable EAD to implement and enforce policy.

Local communities will be empowered to plan and implement own programs, e.g. through training of village technicians. Collaboration with all key stakeholders in formulating, implementing energy programs will be strengthened.

Goal 6. Improved availability of energy information for policy and planning.

The goal is to achieve a nation informed on energy sources and issues through education, awareness campaigns and information dissemination.

This will be achieved when a consolidated and up-to-date national energy resource and energy technology database, supported by necessary legislation and funding is developed through surveys and a consultative process; and capacity for data collection and database development and management and Integrated Energy Planning within EAD is developed.

Energy related R&D to generate new knowledge and data for planning and policy formulation as well as appropriate technologies to address the energy problems of the country will be promoted.

Goal 7. Minimized energy related environmental, safety and health impacts

Improving access to commercial energy for the poor and rural communities will ameliorate the negative environmental and health impacts such as deforestation and indoor air pollution associated with unsustainable harvesting of biomass for fuel wood and charcoal and the use of low level technology such as open fires. Local communities will be empowered to manage their biomass resources and thus avoid overexploitation.

To reduce pollution, minimum performance standards for equipment, vehicles and factories will be established through collaborative approach with the industry and the Botswana Bureau of Standards. Beneficiation of coal will be continued in order to have relatively cleaner coal for energy purposes. More efficient energy technologies will be developed to reduce GHG emissions. Training and capacity building for maintenance and technology upgrades for technicians will be given high priority.

To reduce the use of fuel wood by government institutions which contributes to accelerated deforestation, these institutions will be assisted to switch over to other fuels like coal, gas or electricity.

Goal 8. Strengthened energy trade and cooperation for enhanced energy security and reduction in costs:

Regional and international energy trade and cooperation will result in enhanced energy security for the country through diversified energy sources. It will also enable the country to tap into cheaper energy sources when these are available in the region.

Botswana will continue to be an active member of the regional interconnection of electricity grids and will actively participate in the SAPP and in future projects such as the WESTCOR project.

Development of new energy supply projects will aim to satisfy the needs of the region over and above the country's own needs e.g. the feasibility of exporting power from the Mmamabula power station to the SAPP.

To be able to participate more effectively in regional projects the country will have to rationalize and coordinate the procurement and distribution of petroleum products and participation in the Regional Petroleum and Gas Association and harmonize the legal and fiscal policies and legislation on the production, transport and distribution of energy product to the rest of the region.

Cooperation with other regional bodies will be encouraged in energy related research and in other energy sources such as biofuels in the spirit of SADC and for mutual benefit.

Transport bottlenecks arising from limited supply routes that have been a threat to security of supply can be reduced by developing other supply routes with more countries in addition to South Africa.

On the international scene, the country will take advantage of the clean development mechanism and carbon trading in order to improve energy efficiency and have access to more efficient technology.

Goal 9. Improved energy efficiency for all energy sources in all sectors for economy, increased security and environmental protection

The benefits of energy efficiency include not only savings at individual consumer level but also environmental and foreign currency savings in the import bill for a country like Botswana that imports substantial amounts of energy.

To achieve energy efficiency, minimum energy efficiency standards for all investment and operations must be set and enforced. Awareness programs on the benefits, broader consequences and practice of energy efficiency in all sectors should be implemented. There is also need to improve the knowledge network for energy efficiency practitioners; and energy efficiency should be incorporated into accredited training and education programs.

The pricing for energy services must reflect the scarcity of energy as a resource. The overall tariff levels will be set to encourage efficiency and conservation. Government will encourage private sector investment projects for energy efficiency in all sectors.

Goal 10. An effective and sustainable energy research and development program that addresses the country's energy development priorities

A national energy R&D policy and strategy that identifies priority energy research areas will be developed and funds for energy research mobilized. It is expected the research will generate new information and data for planning and policy. Mutually beneficial collaborative energy research alliances regionally and internationally will be encouraged. Research into the socio-cultural aspects of energy use in order to foster wider adoption of more efficient energy technologies and practices will also be carried out.

The development and/or adaptation of energy technologies and appliances to suit the Botswana situation, address the energy needs of the people and help Botswana achieve one of its Vision 2016 objectives to be a Centre of Excellence in Solar Energy will be carried out in areas such as coal-to-liquids technologies, renewable energy technologies (solar, wind, biodiesel, ethanol etc.) and electricity production, transmission and distribution.

Research co-operation between academia, industry, public and private researchers will be maximized as a way of optimizing resource use.

Information flow between entrepreneurs, Government and the general public will be improved through events such as annual research days etc.

Goal 11. Effective private sector participation and investment at all levels in the energy sector

To promote more private sector participation and to foster competition a national policy on private sector participation in the energy sector and independent power producers which will establish an investor-friendly climate through incentives, good governance, and transparent and stable regulatory framework will be formulated.

An impartial regulator for the energy sector will be established through appropriate legislation. The ESI will be restructured to allow for more private sector participation and competition.

Cost reflective tariffs will be allowed to ensure viability of investors in the sector and participation of citizens in the sector will be promoted through Government assistance. Information on investment opportunities in the energy sector will be packaged for potential investors.

Goal 12 Gender, age and socio-economic status are mainstreamed in all energy policies and programs

To achieve this, efforts will be made to accelerate the representation of women at all levels and in all spheres of energy development and management activities.

Suitable training programs for EAD in gender and other socio-economic aspects of energy development will be formulated and implemented

Gender awareness in all key policy makers will be improved.

7.0 WAY FORWARD

Policy Priorities

The development of the Botswana National Energy Policy sets out to enable government and the private sector to provide reliable, affordable and sustainable energy production and distribution for the country. There is need to prioritize the various policy goals presented for implementation in the short to medium term in line with resource availability. The prioritization exercise will be monitored and coordinated with other policy statements and directions. A high level strategy document will be developed to highlight the short, medium to long term priorities.

A comprehensive implementation plan will be developed after the prioritization has been completed. The plan will focus on the realistic fulfillment of the policy goals and the elaboration of the high level strategies as well as timeframes for implementation of policy in the short, medium and long term.

Revision and monitoring

The development of a National Energy Policy is not a once off exercise. Basic assumptions and priorities will change from time to time. Policy implementation requires resources and the availability of these may also change. The Policy will therefore require to be reviewed regularly in line with the NDP.

The progress on the implementation of the policy will need to be monitored regularly. The energy balance and other selected indicators can be used as a baseline for measuring the results of the implementation of the National Energy Policy. The various selected indicators can be assessed annually and the policy decision makers should then consider if there is need to adjust the means for implementation. The policy goals and statements will need to be discussed and adjusted if necessary at greater intervals say every five years.

Evaluation

There is need for periodical evaluation of the policy. The evaluation is done in a structured way which compares expected benefits of major programs with original assumptions. In many cases, major energy projects have comprehensive feasibility studies stating expected benefits for a specific project e.g. reduced energy cost, employment creation etc. The evaluation exercise should be used not only to generate criticism, but also to gain knowledge on projects and policies to enable better planning in future.

Next steps

This draft policy document will go through the Government approval system before it becomes an official policy document.

1. The draft National Energy Policy document will be presented to the Minister of Minerals, Energy and Water Affairs (MMEWA) together with the High Level Strategy Document that the Energy Affairs Division is currently working on for approval. The high-level strategy document will spell out in very broad terms how the policy goals are to be achieved.

2. The MMEWA will prepare a Cabinet Memo that will be used to seek Cabinet approval of the policy document as an official document of the Government of Botswana. Before approval, the document will undergo further debate in Government circles. This allows for buy-in and ownership by the other Government Ministries which are key to the implementation of the policy. There is also need to give the document maximum publicity to all key stakeholders. This could be through seminars, media briefs and public meetings so that the citizens of Botswana who are affected by the policy not only know about the policy but so that they can also influence the policy implementation process.
3. The detailed strategy with resource allocation will have to be drawn up as a separate exercise once the National Policy has been adopted by cabinet.

8.0 REFERENCES

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