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Technical Report:
**National Energy Policy Strategy Implementation
Plan**

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REPUBLIC OF BOTSWANA

GOVERNMENT OF THE REPUBLIC OF BOSTWANA

Ministry of Minerals, Energy and Water Resources

Energy Affairs Division

NATIONAL ENERGY POLICY IMPLEMENTATION STRATEGY

October 2009

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I. Foreword

To be completed by the Ministry of Minerals, Energy and Water Resources.

II. Introduction

Why do we need an energy policy implementation strategy?

In August 2008 the Energy Affairs Department in the Ministry of Minerals Energy and Water Affairs with the support of the USAID Southern Africa Global Competitiveness Hub (Trade Hub) and United Nations Development Programme (UNDP) developed a draft National Energy Policy that is being considered by the government of Botswana. The draft energy policy has twelve overall goals which are detailed in Section II. However it was agreed that it is important to create a high level strategic implementation plan of the National Energy Policy focusing on the critical objective to provide affordable, environmentally friendly and sustainable energy services in order to promote social and economic development. The fundamental issue in the area of the country's economic growth is the issue of access to energy and security of supply.

This document serves as a high level policy document to explain a strategy and implementation plan to accomplish the twelve goals of the National Energy Policy.

The strategy development process

The methodology employed to create the strategic implementation plan was as follows:

- **Meetings with key government stakeholders** with the responsibility to carry out the National Energy Policy;
- **Discussions with investors** to understand the feasibility of the strategic implementation plan;
- **Review of documents** provided by government officials and private investors; and
- **Best practice research** based on other jurisdictions as well as other sources.

This Strategic Implementation Plan is not assumed to be exhaustive. Instead, it embodies a high level overview that is further detailed in specific reports as explained in the report.

III. Strategy for Energy Policy Implementation

1.0 The Main Issues of the National Energy Policy

Botswana's Energy policy that was approved by the stakeholders in early 2009 includes the following twelve goals to accomplish the philosophy and overall vision.

Energy Policy Goal 1. Improved Security and Reliability of Energy supply to all sectors of the economy.

Security and reliability of energy supply must be provided to facilitate economic growth and to sustain the economy. In order to attain security and reliability of energy the government has to:

- a) Keep 90 days petroleum products in the Government Strategic Stocks;
- b) Private sector to keep at least 14 days of the commercial buffer stocks;
- c) Local production of diesel as biodiesel contributing to at least 20% of the diesel supply;
- d) Electricity generation must achieve 100% local generation capacity and based on abundant coal resource target the regional export market;
- e) Solar based power alone must contribute at least 20%;
- f) Biogas contributing 3% of the national gas requirements;
- g) Establish infrastructure geared toward the promotion of local coal utilization in all districts to enhance availability and reliability; and
- h) Pursue other routes and areas of supply of petroleum products other than from the Republic of South Africa.

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

In pursuance to improving access to affordable conventional energy services across sectors, there is need to:

- a) 100% access to electricity;
- b) Reduce distance to filling stations to at most 10 km;
- c) Electrify all rural villages, towns and cities (15 villages per annum);
- d) Extend grid in already electrified rural villages, towns and cities (12 villages per annum);
- e) Establish an affordable national standard connection cost (house-wiring inclusive); and
- f) Establish coal depots in all districts to improve access to coal.

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

- a) Develop the energy sector to facilitate the least cost energy mix energy supply; and
- b) Creation of job opportunities for rural communities.

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

In order to facilitate effective and smooth operation of the energy sector, a much more appealing institutional structure dealing with energy governance will be put in place.

- a) The government will assume a facilitation role of policy formulation to create a conducive economic environment.
- b) An independent Energy Regulator will be established.

- c) National Petroleum Company will be established to manage Strategic Stocks and NPF.
- d) Energy production will be liberalized to allow private sector participation;
- e) An independent Oil Industry Secretariat will be established.
- f) The Government will where sub-sector is not developed put subsidy and or infrastructure and lease out the facilities to the private sector to operate such businesses objectively for later take off.
- g) Feed-in-tariffs from new and renewable sources of energy (NRSE) power generated sources be in place.
- h) The Botswana Power Corporation will continue to be responsible for power generation and supply including provision of solar based energy.

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

- a) Appropriate energy training be provided at all levels of education;
- b) The Department officials will be continually enhanced and skilled to fulfill their mandate effectively; and
- c) The Department will be adequately staffed to deal with issues on Energy.

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

The general public as the core customers must be continually made aware of the energy services through targeted awareness campaigns.

Energy Policy Goal 7. Minimized Energy related Environmental, Safety and Health impacts.

All energy projects and programs must adhere to the best international practices related to the environment, safety and health issues. In order to achieve the Millennium Development Goals (MDGs) of the World Summit for Sustainable Development held in 2001 in Johannesburg access to energy services is a per-requisite.

All activities on energy extraction, generation and utilization must be preceded and informed by an Environment Impact Assessment to minimize impact on the environment, health and safety.

The government will pursue to achieve the use of cleaner fuels:

- a) 100% use of unleaded petrol;
- b) 5% sulfur diesel;
- c) 20% power generated through the use of the New and Renewable Sources of Energy (solar, biofuels);
- d) All institutions to use other sources of energy other than firewood; sources such as washed/cleaner cheaper coal be promoted; and

- e) A carbon sink (reservoir of **carbon**: an environmental reservoir that absorbs and stores more **carbon** than it releases, thereby offsetting greenhouse gas emissions), Botswana will opt for the best available technology internationally to reduce GHG on her energy development.

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

The Government of Botswana value creating conducive business environment to the development and promotion of energy supply industry, and to provide for matters connected with or incidental thereto.

- a) Energy Services should be supplied at least cost to the economy with the energy supply industry operating efficiently.
- b) Facilitate private investment in the energy sector; eg Electricity Supply Act 24.12.2007 promoting the creation and licensing of independent producers and suppliers of electricity.

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

The Government will continue to emphasize energy efficiency and conservation to reduce wastage.

- a) 10% power saved through energy efficiency and conservation endeavors (energy saving practices, awareness campaigns, energy efficient. Equipment and the general energy demand management).

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

- a) Energy Research and Development will be strengthened in the field the utilization of nuclear energy.
- b) Best technologies use for utilization of our abandon coal resources with special reference to coal gasification, solid to liquid appropriate equipment.

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

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

Gender mainstreaming is essential to recognize available choices of energy sources for household energy supplies; this will facilitate prioritization of various target groups, especially the welfare of women, children and the general marginalized groups.

2.0 The Philosophy and Aims of Botswana Energy Policy Strategic Implementation

3.1 Vision Statement for Botswana’s Energy Policy

The goal of the Botswana Energy Policy is to pursue and implement a strategy that works with consumers, service providers and the government to ensure the provision of adequate, efficient, reliable, safe and least-cost energy services in an environmentally responsible manner to an ever expanding set of energy customers.

3.2 Overall Objectives

The overall objectives of the Botswana Energy Policy Implementation Strategy Plan are to translate the twelve energy policy goals into specific aims and an action plan for eventual implementation.

From the twelve goals, five areas were identified that will be implemented using several institutional. These five areas include:

- Institutional arrangements;
- Energy Efficiency;
- Increasing Access to Modern Energy;
- Renewable Energy Programs; and
- Security of Supply.

The above areas are further explained in the following sections.

3.3 Specific Aims

The following figure identifies the specific aims to achieve the twelve goals described in the Botswana energy policy and summarized in the previous sections. As shown below, the following aims addressed all twelve energy policy goals.

Figure 1: Botswana Energy Policy Goals as they Relate to the Strategic Implementation Plan

Detail	Institutional Arrangements	Energy Efficiency	Increasing Access to Modern Energy	Renewable Energy Programs	Security of Supply
Goal 1: Improved security and reliability of energy supply to all sectors of the economy.	√				√
Goal 2: Increased	√				√

Detail	Institutional Arrangements	Energy Efficiency	Increasing Access to Modern Energy	Renewable Energy Programs	Security of Supply
and equitable access to affordable energy services for all sectors of the economy, particularly the low income and marginalized.					
Goal 3: Energy contributing to socio-economic development and social well being of all the people of Botswana.	√		√	√	
Goal 4: Effective institutional arrangement and governance for the energy sector.	√				
Goal 5: Improved capacity for service delivery for all key stakeholders in the energy delivery chain	√				
Goal 6: Improved availability of energy information for policy and planning	√				
Goal 7: Minimized energy related environmental, safety and health impacts		√		√	
Goal 8: Strengthened energy trade and cooperation for enhanced energy					√

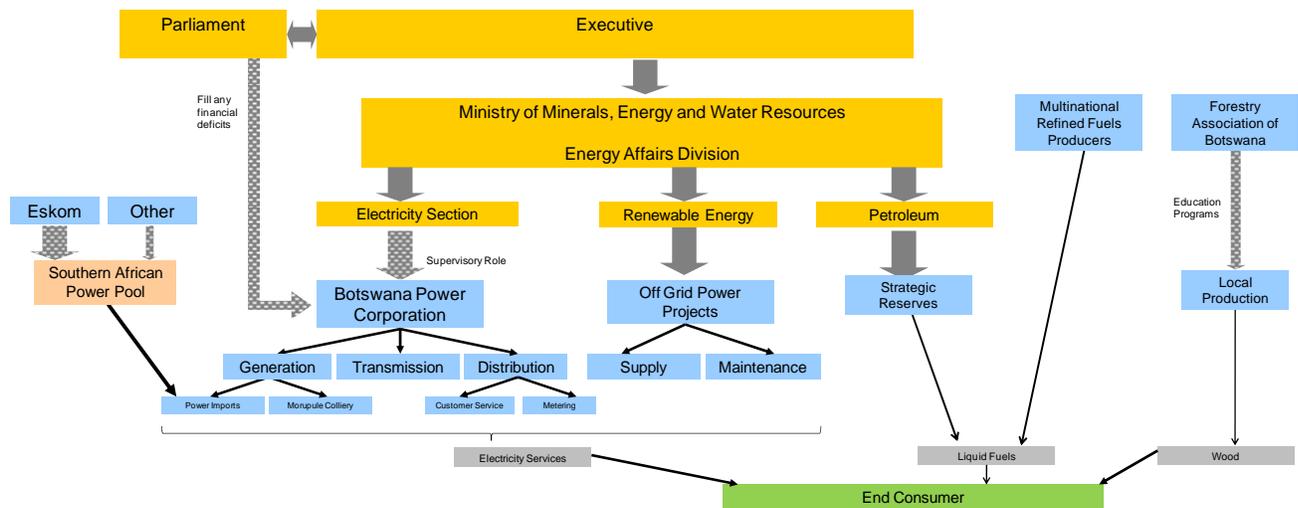
Detail	Institutional Arrangements	Energy Efficiency	Increasing Access to Modern Energy	Renewable Energy Programs	Security of Supply
security and reduction in costs					
Goal 9: Improved energy efficiency for all energy sources in all sectors for economy, increased security and environmental protection		√			
Goal 10: An effective and sustainable energy research and development program that addresses the country's energy development priorities		√			
Goal 11: Effective private sector participation and investment at all levels in the energy sector	√			√	
Goal 12: Gender, age and socio-economic status are mainstreamed in all energy policies and programs			√		

3.0 Structure of Botswana Energy System

The purpose of this section is to highlight the current organizational structure over the regulation of Botswana's energy sector and services. This report will not attempt to re-create the detailed examination of available energy resources as well as supply and demand for energy services explained in the Botswana Energy Policy.

An important consideration to accomplish the goals in the Botswana Energy Policy is to study the current energy regulatory framework. **Figure 2** shows the structure of regulation in Botswana for energy services.

Figure 2: Botswana Energy Sector Structure



Source: Author's construct based on Botswana Energy Policy paper and other research

4.0 Increase Supply: Institutional Arrangements

The task to increase energy supply rests primarily on the creation of an investment environment in which domestic and foreign investors feel comfortable with the notion of putting considerable financial capital at risk in Botswana. Given the nature of capital intensive energy related projects, establishing appropriate institutional arrangements becomes paramount to assuring adequate energy supplies.

The main institutional arrangements required to create such an environment are: 1) Generally accepted accounting principles; 2) Creation of energy regulator; and 3) Independent Power Producer framework. These will be explained in further detail below.

4.1 Generally accepted accounting principles

Investors generally expect that a clear set of rules are established prior to any signed contracts and commitment of financial and human resources. As such, accounting regulation is the first pillar of institutional arrangements that are required to assure investors that their assets, liabilities, revenues and costs as well as other items are accounted for in a consistent manner in accordance to international best practice.

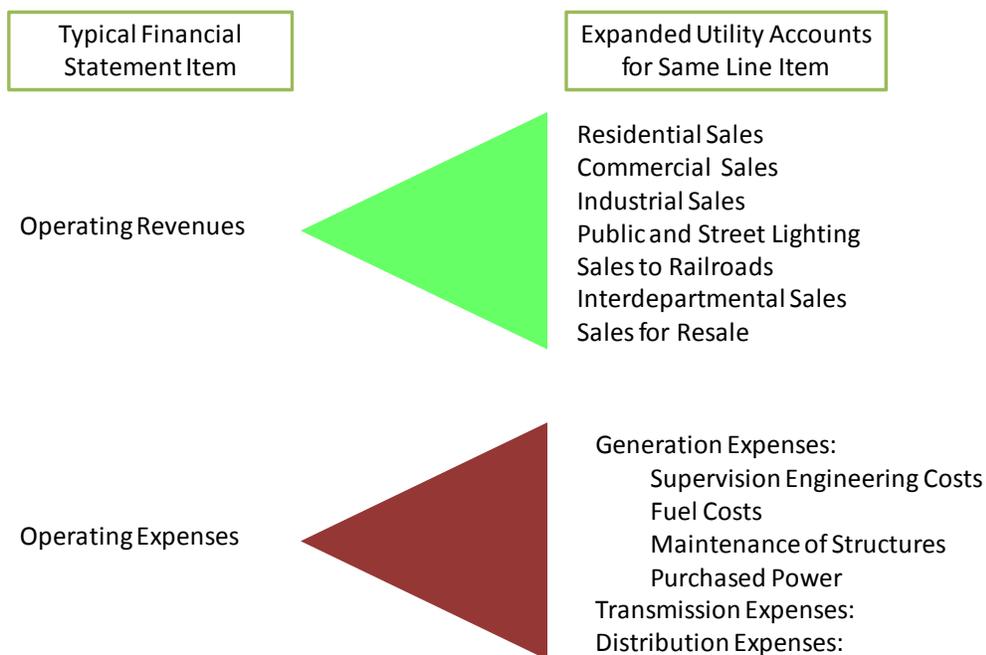
Utilities such as the Botswana Power Corporation (BPC) already report its accounts to the relevant statutory and tax authorities. Nevertheless, utility regulators require much more detailed account information in order to properly supervise the accuracy and

fairness of tariffs. As such, utility regulatory accounts exist separately from financial or tax accounts. Without a detailed set of accounts, however, regulators are unable to ensure consistent reporting among regulated companies, are incapable of preventing pricing mistakes or abuses by the company (such as undue cross subsidies between customers), and cannot uncover illicit affiliate transactions or the subsidization of unregulated subsidiaries.

The history of utility regulation in the United States (U.S.) provides a useful narrative to the abuses that occurred prior to the establishment of generally accepted accounting principles for utility assets. Since the inception of the Uniform System of Accounts in 1938, U.S. energy utilities rarely engage in significant disputes with their regulators over fundamental financial items (like profitability, depreciation expenses, customer contribution, admissibility of particular costs or the treatment of unregulated affiliates). An example of utility accounts for electric utilities is those published by the U.S. utilities to the US Federal Energy Regulatory Commission (FERC) in the Form 1.¹ However, in the United Kingdom, without a regulatory-mandated accounting system for regulating prices, major components of every tariff review concern costly and time-consuming fights over basic accounting and finance items.

Given the resource constraints faced by the Botswana government and the eventual new energy regulator, the regulator’s time should not be spent arguing over basic financial line items, but over other more complicated issues.

Figure 3: Example of Utility Accounts



¹ See FERC Form 1 at <http://www.ferc.gov/docs-filing/forms.asp#1>. Form 1s are published by every utility and includes detailed account information that are specific to electric utilities.

Note: Only an abbreviated example of utility accounts. For more specificity, see complete FERC Form 1.

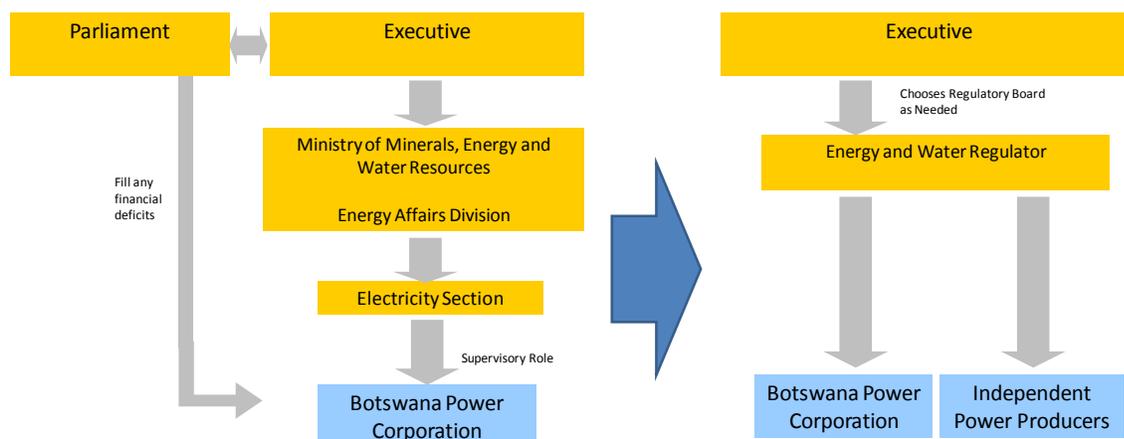
4.2 Creation of Energy Regulator

Along with utility accounting regulations, a second pillar of the instructional arrangements needed to motivate further energy related investment is the creation of an energy regulator. Energy utility regulators have two primary responsibilities. First, regulators ensure that energy utility companies supply the public safely, adequately and at reasonable prices. Second, regulators ensure that the resulting regulations do not diminish the property rights of those companies who provide the regulated services. This latter duty is both a legal and a practical one. Without an assurance that regulators will not seize the property of regulated companies, the energy firm cannot maintain sufficient financial integrity to be able to engage in the ongoing capital commitments necessary to provide uninterrupted service.

As shown in **Figure 2** the main electric utility in Botswana is supervised by the Ministry of Minerals and Energy with rate changes handled by the Cabinet and Parliament. This arrangement creates an environment where the utility is not reasonably certain if it will recover necessary operating and capital expenses required to deliver electricity to its customers.

As such, the energy regulator creates an independent institution that can decide on the utility's rates among other issues without the need to directly involve the country's executive or legislative process. As shown in **Figure 4** the regulation over BPC and new Independent Power Providers (IPPs) would move to the new energy and water regulatory and away from the Ministry. Deficits at the utility level would be handled through the regulatory process and recovered from rate payers instead of tax payers.

Figure 4: New Energy Regulatory Structure



4.3. Independent Power Producer Framework

The third pillar of the instructional arrangements needed to motivate further energy related investment is the establishment of an IPP framework.

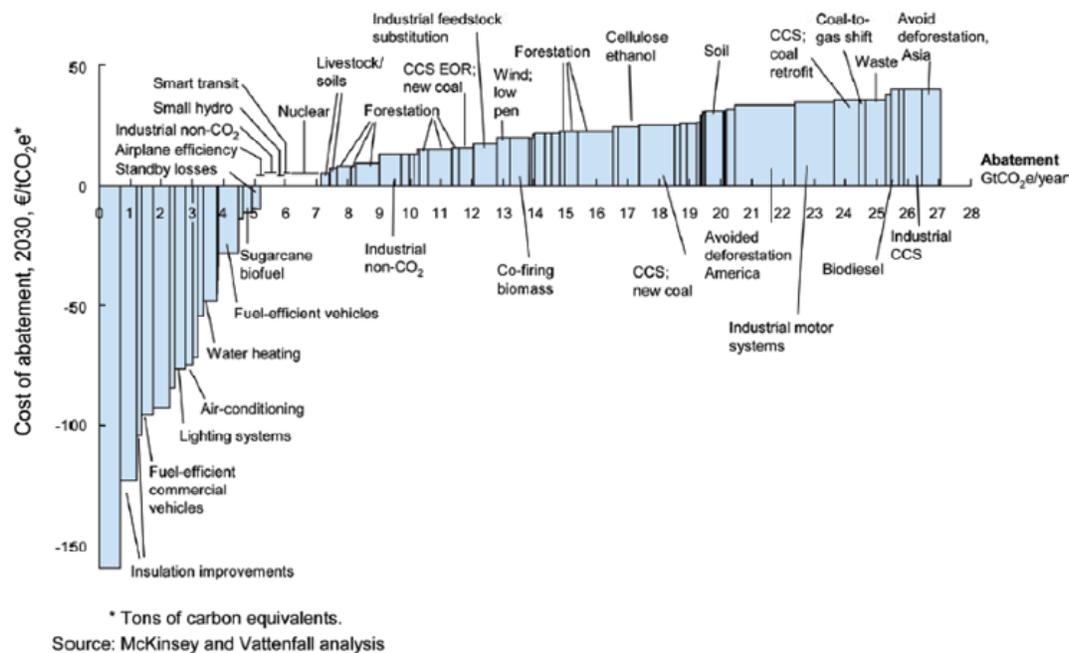
[Mr. T.C. Matshameko is to provide IPP document written by external consultant]

5.0 Energy Efficiency/Demand Side Management

Aside from examining institutions to aid to increase supply of energy resources, demand side management (DSM) or energy efficiency programs is a cost effective approach to address energy security and other goals in Botswana’s Energy Policy.

Best practice is increasingly titling towards using energy efficiency program as part of a comprehensive energy policy strategy program. The California Public Utilities Commission (CPUC), the energy regulator for the U.S. state of California, states that “[e]nergy efficiency is California’s highest priority resource for meeting growing energy needs in a clean, low-cost manner and reducing greenhouse gas emissions.”² This is supported by analytical data by the global strategy consulting firm, McKinsey & Company, which details how energy conservation is the most economically efficient manner to reduce both energy use per capita and decrease the production of greenhouse gases.³

Figure 5: Cost Curve of CO2 Abatement Programs



² California Public Utilities Commission.

³ “The Carbon Productivity Challenge: Curbing Climate Change and Sustaining Economic Growth,” McKinsey & Company, June 2008.

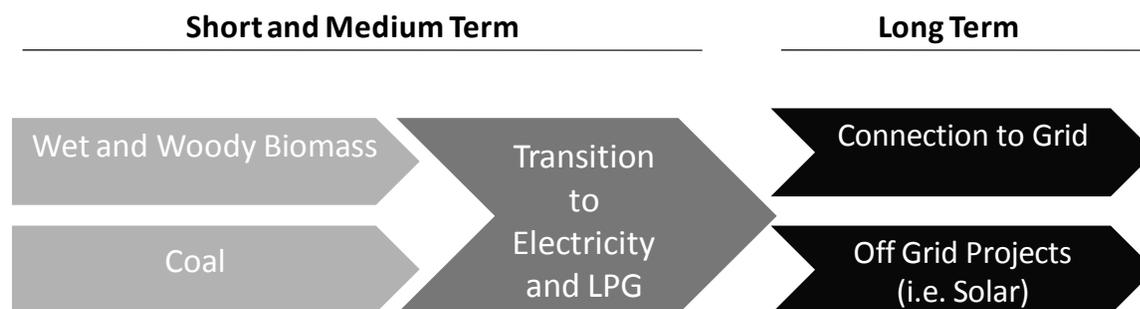
6.0 Increase Access to Modern Energy

In accordance to the goals of the Botswana Energy Policy, increasing access to modern energy is a main strategic goal to further national economic development.

As detailed in a World Bank Report, “The Welfare Impact of Rural Electrification: A Reassessment of the Costs and Benefits,” increasing access to modern energy leads to increased productivity and economic growth for those communities that previously had to rely on wood or animal labor. The World Bank found that electrification efforts in Ghana have resulted in an increased local entrepreneurship. In a fundamental manner, the availability of modern energy contributes to economic growth and productivity. For instance, artificial light enables productive work to occur during the darkness of night and artificial force produced from machines magnifies the natural physical capacity of human beings.

Given the geography and large distances between cities and towns in Botswana, it is not always practical to extend transmission and distribution lines to every village in the country. As such, the goal to increase access to modern energy is tied to renewable energy goals that are discussed in the next section as shown in Figure 6. In addition, given the available natural resources in Botswana such as coal, the strategic implementation plan to increase access to modern energy must be comprehensive in nature with a short, medium and long term timeline.

Figure 6: High Level Strategy to Provide Modern Energy in Conjunction with Renewable Energy Strategy



7.0 Renewable Energy

In line with the goals of the Botswana Energy Policy, a significant component to increase access to modern energy and minimize the environmental impact of energy production relies on encouraging the use of renewable energy sources. Given the available resources in Botswana, the two primary vehicles to implement a renewable energy source policy rely upon the use of biomass and solar energy. As detailed in the Botswana Energy Policy, the lack of wind resources generally eliminates this source of energy from the available renewable energy portfolio.

The Ministry of Minerals and Energy have carried out detailed strategic implementation plans for biomass and some studies related to solar energy. As such, this section is partly a summary of those plans and discussions with the relevant stakeholders.

7.1 Biomass

The biomass strategic implementation plan can be found in detail in the March 2009 Final Report entitled, “Botswana Biomass Energy Strategy.” This strategy document identified the following policy objectives as it relates to biomass energy:

- Promotion of community based natural resource management of fuelwood;
- Promotion of other alternative biomass energy sources e.g. biogas;
- Eradication of fuelwood utilization in Government institutions;
- Collaboration with the Department of Forestry and Range Resources (DFRR) on the enforcement of the veld products (fuelwood) regulation;
- Introduction and promotion of energy efficient biomass equipment and technologies; and
- Implementation of a biodiesel pilot project intended to produce 11 Mega liters of biodiesel per annum by 2016.

This section is only a high level summary of the Botswana Biomass Energy Strategy document and is not assumed to be comprehensive. In addition the policy goals, it identified an implementation plan for several biomass subsectors such as woody biomass, wet biomass and biofuels.

7.2 Biomass

In accordance to the high penetration and use of woody biomass through the country, the more efficient use of woody biomass and use of coal when possible was identified as a strategic goal. In the long term, the goal is to provide modern energy in the form of electricity or gas for heating, cooking and lighting needs.

7.3 Biogas

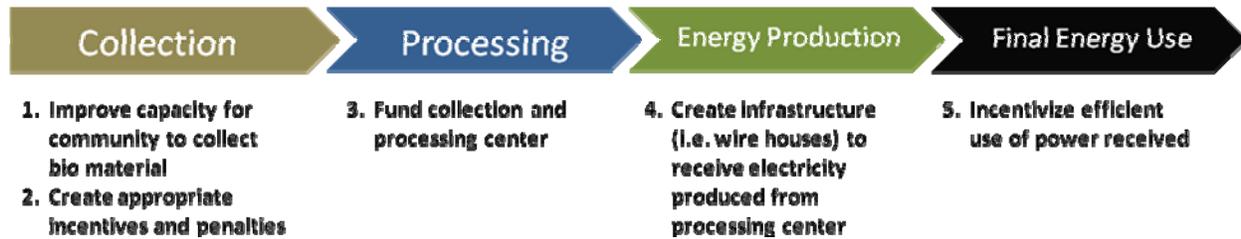
As the biomass strategy document states, wet biomass suffers from a lack of knowledge and absence of efforts to exploits its energy resource potential.

Issues and barriers that relate to biogas are as follows:

- Increase awareness of the resource potential of biogas;
- Increase acceptability of this energy resource; and
- Develop capacity for developing biogas resources in some areas.

As shown below, the production of power through bio materials requires several steps and the allocation of human and financial resources. The biomass strategy document provides specific timelines. Nevertheless, **Figure 7** provides a high level strategy to exploit the use of this readily available resource in many communities.

Figure 7: Biogas Energy Production Process Chain and Strategy



7.4 Biofuels

The last area in the biomass energy strategy is the integration of biofuels into the liquid refined petroleum supplies. Several main strategic policy goals were identified:

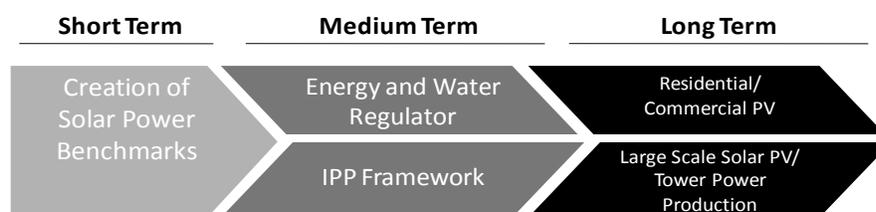
- The use of energy crops that do not conflict with food crops;
- Identification of jatropha as a crop that makes use of the available limited water resources in most of Botswana;
- Prioritize production of jatropha by private sector;
- Government funded processing plant for jatropha; and
- Increase to production of biofuels.

7.5 Solar

The second pillar of Botswana’s renewable energy policy is the use of solar energy. Given the high availability of solar energy throughout the country, several technologies were identified to best make use of this resource such as Photovoltaic (PV), solar towers and solar heaters.

In contrast to the biomass sector, no benchmarks have been established for solar energy use penetration. As such, this strategic implementation document includes the short term goal to establish benchmarks in accordance to international best practice. As shown in **Figure 8**, in the medium term, the creation of the Energy & Water regulator and the IPP framework will assist in attraction of private investment in residential and commercial solar projects as well as larger grid projects.

Figure 8: Solar Energy High Level Strategy

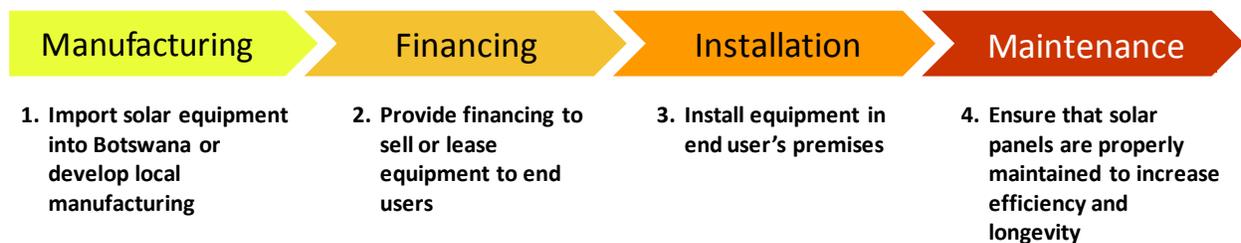


7.5.1 Solar PV

Given the current transmission and distribution electrical infrastructure, solar PV can provide a means to achieve the goals to provide modern energy to a larger percentage of consumers as well as increase the share of power produced by renewable and environmentally sustainable sources.

As shown in **Figure 9**, the strategy to increase the use of solar PV involves the participation by both the public and private sectors in all or segments of the process chain for solar PV panels.

Figure 9: Process Chain for Solar PV and Opportunities for Public and Private Sector Participation



7.5.2 Solar Heaters

Analogous to the use of solar PV panels, solar heaters provide increased access to modern energy to a greater proportion of the Botswana population.

7.5.3 Solar Thermal

In addition to solar panels that can provide modern energy needs at the residential and commercial level, solar water towers has the potential to larger amounts of power.

BPC has a draft prefeasibility study for a 200MW Solar Thermal power generation facility.

8.0 Security of Supply

The security of energy supply is a final issue addressed in several of the Botswana Energy policy goals. As **Figure 10** shows, petroleum consumption in Botswana has increased significantly since 1980.

Figure 10: Increasing Petroleum Consumption in Botswana 1980-2008



Source: US Energy Information Administration

Given the increasing demand for petroleum products in Botswana, which are imported through surrounding countries, the Botswana Energy Policy expressed several goals relating to creating a sustainable strategy to ensure the security of supply.

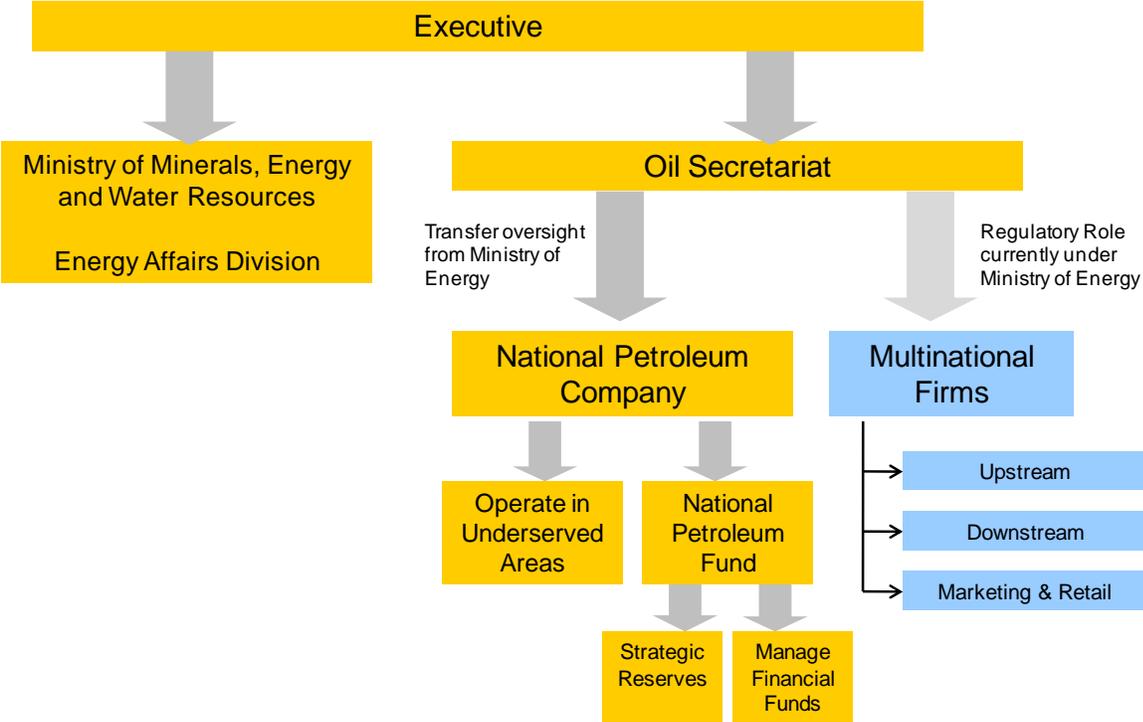
Issues relating to security of supply are as follows:

- Explore options other than South Africa as the main source for fuel imports;
- Increase the strategic petroleum stockpile to 90 days;
- Ensure the sustainability of the National Petroleum Fund;
- Establish the National Petroleum Company; and
- Create the Oil Secretariat.

As shown in

Figure 11, the above proposes will lead to the following regulatory structure for the oil industry in Botswana.

Figure 11: Proposed Oil Industry Regulatory Structure



9.0 Implementation of the Strategy and Monitoring

This section explains the institutions that will need to be established in order to implement the high level strategy detailed in the previous section. The primary institutions are the following:

- Energy Water Regulator;
- IPP Framework;
- Energy Efficiency Office;
- Modern Energy Access Office;
- Renewable Energy Office;

- Oil Secretariat; and
- National Petroleum Company.

The following figure explains how the above institutions will work to implement the goals of the Botswana Energy Policy.

Figure 12: Botswana Energy Policy to Strategic Implementation Plan

Detail	Institutional Arrangements		Energy Efficiency	Increasing Access to Modern Energy	Renewable Energy Programs	Security of Supply	
	Energy & Water Regulator	IPP Framework	Energy Efficiency Office	Modern Energy Office	Renewable Energy Office	Oil Secretariat	National Petroleum Company
Goal 1	√	√				√	√
Goal 2	√	√				√	√
Goal 3	√	√		√	√		
Goal 4	√	√					
Goal 5	√	√					
Goal 6	√						
Goal 7			√		√		
Goal 8						√	√
Goal 9			√				
Goal 10			√				
Goal 11	√	√			√		
Goal 12				√			

10.0 Organization, Administration and Community Involvement

10.1 Creation of Energy/Water Regulator

The creation of a Botswana energy and water utility regulator will require additional full time equivalents to be distributed in electric and water, customer service, public advocate, legal, chief executive officer office, and full-time regulators.

Table 1: Potential Job Positions Needed for Botswana Utility Regulator

Department/Area	New Positions
Electric and Water Pricing and Compliance Department	Department Head License and Compliance Staff Pipeline Safety and Inspection Staff Tariff Review Staff
Prosecutorial Counsel	Lead Prosecutorial Attorney Prosecutorial Attorney Administrative Assistant
Electricity Pricing and Tariffs	Utility Analyst (Electricity) ¹
Regulatory Analysis and Research Department	Senior Regulatory Analyst Regulatory Analyst
Office of General Counsel	Regulatory Attorney ²
Customer Service	Customer Service Coordinator Customer Advocate Utility Analyst Filing Clerk Call Centre Representative ³
Record Filing Office	Web Content Coordinator Record Filing Clerks ⁴
CEO office-coordination	CEO Office Coordinator

¹ Only necessary for the annual tariff reviews alternative.

² One position needed for 4 or 5 year reviews. Two positions needed for annual tariff reviews.

³ Three positions needed at the beginning, might expand to 10 once the public knows of Call Center.

⁴ Two positions needed for 4 or 5 year reviews. Three positions needed for annual tariff reviews.

11.0 Financial Implications

Regulatory agencies should be expected to operate in an efficient, cost-effective manner, while meeting their statutory and other obligations. One way to do this is by achieving synergies (that is, cost efficiencies) by regulating more than one industry. Botswana should be expected to achieve efficiencies that benefit all utility customers, as it begins to regulate more than one utility industry.

The comparison is done as the cost of the regulatory agency per person per year as a percentage of GDP per capita or, in other words, the percentage of income that the agency cost represent per person per year. This percentage maps a wide interval because Mexico presents a very low value (0.0018 percent) while Peru presents a very high value (0.05 percent).