



Energy Policy Brief

Reflecting on the Challenges of Attaining a Green Economy¹ for Botswana

Introduction

This policy brief is aimed at raising awareness on the status, challenges and opportunities of the energy sector in Botswana. The policy brief captures progress to-date in expanding access to energy services, reflects on the challenges of the sector in light of the national concerns of energy security and the global concerns of expanding access to energy services to meet the Millennium Development Goals while protecting the environment. This is especially pertinent at this time when the atmosphere is currently suffering from an ever rising concentration of carbon dioxide and other Green House Gases. The balance between the global demands for cleaner energy in the interest of humankind and those of national energy security form a complex interplay which this policy brief seeks to articulate for the benefit of appropriate reforms in the energy sector.

Status of Energy Services

Botswana's energy sources consist primarily of electricity, fuel wood, Liquefied Petroleum Gas (LPG), petrol, diesel and aviation gas. Solar, biogas and biodiesel constitute a small proportion, about 1 %. LPG and all the petroleum-based fuels are imported. Fuel wood usage has been declining over the years while LPG and electricity consumption has been on the rise.

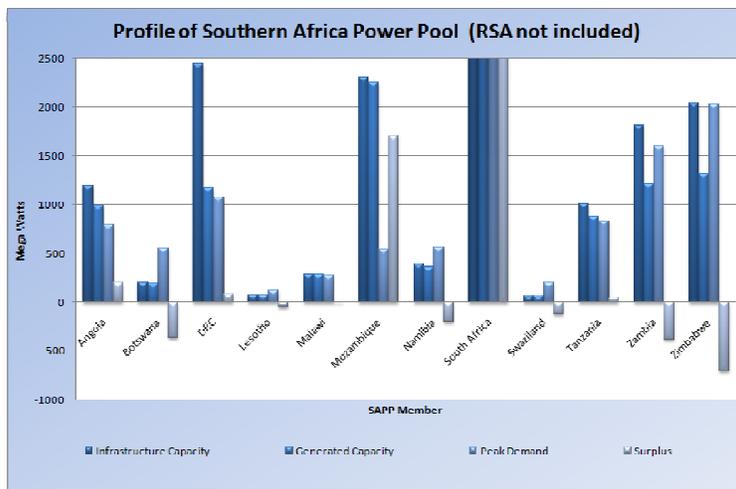


Figure 1: Profile of member states of the Southern Africa Power Pool showing the capacity of energy infrastructure, current production levels and the demand deficits.

Botswana is one of the countries experiencing electricity shortages and in this category are Lesotho, Namibia, Swaziland, Zambia and Zimbabwe.

Local energy resources considered to be in abundance in Botswana include coal (200 billion tonnes), sunshine (3200hrs at 21MJ/m²), biogas (2.2 million cattle, 3kg dung/LSU/day) and fuel wood (200 tonnes/annum). Petroleum products (LPG, petrol, diesel and paraffin) are imported. The scale of their use does not however match their levels of availability. Reasons for these mismatches are discussed under challenges. According to the 2007 snap-

¹ A Green Economy is one that results in improved human wellbeing and social equity, while significantly reducing environmental risks and ecological scarcities(United Nations Environment Programme, 2011). Operationally, it entails adoption of low carbon options, greater resource efficiencies and social inclusion.

shot (Figure 2 below), petrol is the most consumed energy source (33%), followed by coal and electricity (25% each), diesel (12%) and other sources at about 1% each including solar. Although the snapshot does not include fuel wood, the 1981-2003 trend shows fuel wood consumption being higher than petrol and diesel combined (Central Statistics Office, 2007), and declining only slightly at the end of 2003. Consumption of petroleum products had, in 2007, exceeded 1,500Mm³ but started to decrease during the fuel price-hikes of 2008 to 800Mm³ and stabilised at just around 900Mm³ (Energy Affairs Department, 2012).

Consumption by sector shows the transport sector as the largest consumer of energy at 43% of the total national energy (Energy Affairs Department, 2007), mining as the largest consumer of electricity and households as the largest consumers of paraffin. With paraffin

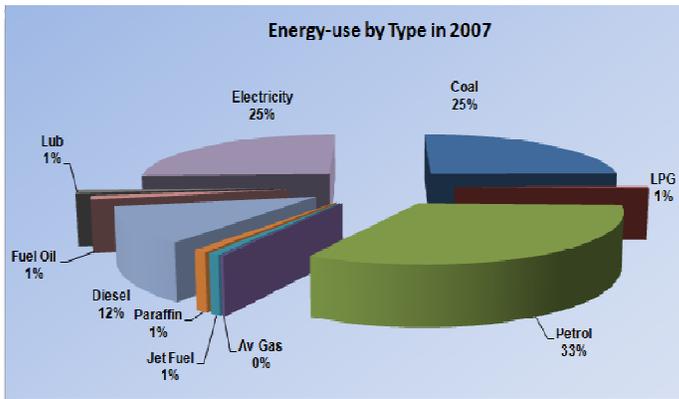


Figure 2: A snap-shot of energy consumption in 2007 showing the different energy sources, measured in Tonnes of Oil Equivalent – TOE (Energy Affairs Department, 2007).

prices having escalated and surpassed those of diesel and petrol, poor households have been the most affected by the fuel-price hikes. With poverty in Botswana having a gender bias, such increase will by inference affect women more than men. Wood resources are not reflected in the 2007 energy report but are an important and dominant contribution to the energy budget of many households, especially in rural areas. Wood resources are managed by the Department of Forestry and Range Resources under the Ministry of Environment, Wildlife and Tourism.

In meeting the multiple demands of rural households where the costs of drawing electricity power-lines may be prohibitive, the Botswana Power Corporation (BPC) has partnered with Electricity de France (EDF) and formed a private company – BPC-Lesedi which operates through a franchise model to provide integrated energy packages of solar home systems, solar lanterns, wood-efficient stoves and heat-retention cooking bags. The company now has branches in Gaborone and Maun with five franchisees servicing over 100 customers in just 12 months (see Figure 3). Other services within BPC-Lesedi include solar water heaters and stand-alone electricity-generating stations powered through a hybrid of solar and biogas. One such station is under design for Sekhutlane village. A solar-powered electricity-generation station is under design for Phakalane, north of Gaborone. The station will generate electricity with a feedback mechanism into the main grid. A policy is already in place to make provision for independent power generators, therefore facilitating private sector investments into the energy sector.

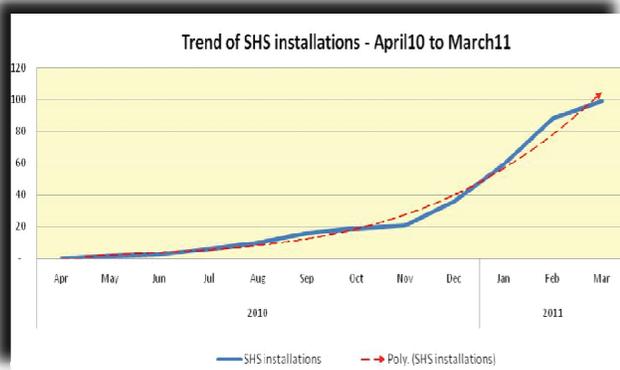


Figure 3: Trends in acquisition of Solar Home Systems through BPC-Lesedi during March 2010 and April 2011 (Source: BPC Lesedi).

Biogas is another area receiving attention as a clean energy technology also addressing waste management through recycling. Cumberland Hotel in Lobatse is recycling food waste to generate gas for cooking and powering water boilers. In less than 2 years, the investment is believed to have paid for itself through savings in LPG.

Challenges Facing the Energy Sector

Botswana’s energy demand outstrips its supply, while her untapped energy sources are also high enough to meet both local and exports volumes. At 200 billion tonnes of coal, a range of opportunities exist for local and export market energy generation, direct export of coal to many of the European and Asian markets, and local processing into a number of by-products. Coal by-products include fertilisers, gas, liquid energy, and coal-bed methane. These by-products can reduce the direct use of coal for electricity generation.

The level of consumption of petroleum products represents a significant energy challenge for Botswana. This challenge is more deep-rooted as it touches on the value of exports vs. imports and the volatility of the oil prices which has huge implications on the country’s import bill. Interrelated factors contributing to the high consumption of petrol and diesel, mainly by the transport sector (see Figure 4 on page 2) include ineffective public transport, lack of NMT infrastructure and as per Axelrad (1998), sprawled human settlements (Axelrad, 1998). In addition to the economic volatility, high consumption of petroleum products increases Botswana’s Green House Gas (GHG) emissions with negative implications for the wider human race in terms of climate change.

The lack of gender disaggregated data to establish who uses what type of fuel and for what purpose, which could be used by energy policy makers and programme developers, hinders efforts to increase access to cleaner forms of energy in the country. The same challenge was noted during the Gender and Energy Audit for Botswana in 2006 (Wright, et al., 2006).

Fuel wood continues to play a significant role as an energy source for many households, especially in rural areas. It is the principal energy source used for cooking in 46 percent of the households nationally; and in 77 percent of households located in rural areas (Central Statistics Office, 2007). This represents a decline from around 90% in 1981 but still significant enough to attract policy attention. The use of fuel wood touches on biodiversity

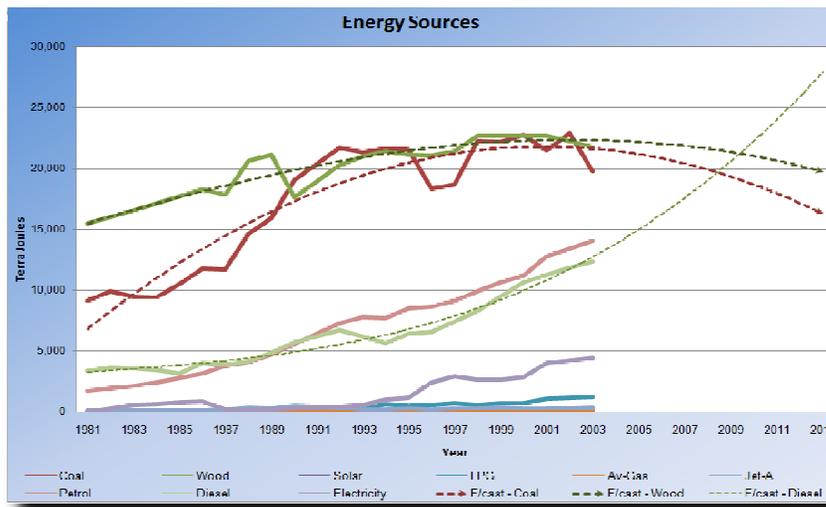


Figure 4: Energy trends for the period 1981-2003 with forecasts on fuelwood, coal and petrol (original data from (Central Statistics Office, 2007)).

conservation and gender in that without a system that allows local community management of woody vegetation and the overall suite of range resources, depletion is likely to occur as more resourced citizens harvest at rates higher than those at which nature can replenish the wood resources. As with wildlife, the capacity of government to monitor wood resources is limited and without the management of fuel wood quotas being devolved to local communities and the requisite local capacity

developed, it is the poor who stand to lose. Collection of fuel wood for day-to-day domestic use is mainly the responsibility of women and children. With depletion of wood resources in areas closest to homesteads, more time is spent in fuel wood collection thus depriving children of study-time and women of other productive uses of time such as commercial activities, adult (distant) education, or participating in village governance structures.

Exposure to smoke from traditional cook-stoves and open fires – the primary means of cooking and heating for nearly three billion people in the developing world – causes 1.9 million premature deaths annually, with women and young children the most affected. Reliance on biomass (for cooking and heating) forces women and children to spend hours each week collecting fuel wood. Six hundred and fifteen million people in sub Saharan Africa rely on biomass while only 132 million have access to electricity, LPG and paraffin (Clean Cook Stoves Organisation,

2011). The population of Sub-Saharan Africa is just over 800 million. This high reliance on biomass for cooking is also prevalent in Botswana

Institutionally, the management of fuel wood resources straddles two ministries; Ministry of Environment, Wildlife and Tourism (MEWT) and the Ministry of Minerals, Energy and Water Resources (MMEWR). The MEWT role is that of conservation and sustainable use while that of MMEWR is provision of energy services. The two functions have ample area for fruitful collaboration though currently not evident. Vis-à-vis information management, the MEWT is mandated with preparing inventory of the resource and its management. The MMEWR is mandated with consumption rates and patterns, and technologies that improve efficient utilisation. Both these elementary records are several years out of date.

Energy for agriculture also presents challenges both in-terms of access and quality. The remoteness of many farms makes grid-electricity uneconomical because of high connection costs and transmission losses. Connection costs can be passed to the consumer but that only makes the agricultural sector less profitable. The use of petroleum products, especially diesel is also problematic as it increases the volatility of agricultural production costs and increases Botswana's GHG emission levels. Diesel is usually used to power generators and borehole water pumps. In the traditional agricultural sector, many farmers use manual labour for underground water abstraction. As shown in Figure 5 below, 21% of the underground water extraction uses manual labour. This has implications for women farmers as they may not have the muscle power to undertake this exercise, especially considering the

technology is not designed to accommodate women and children.

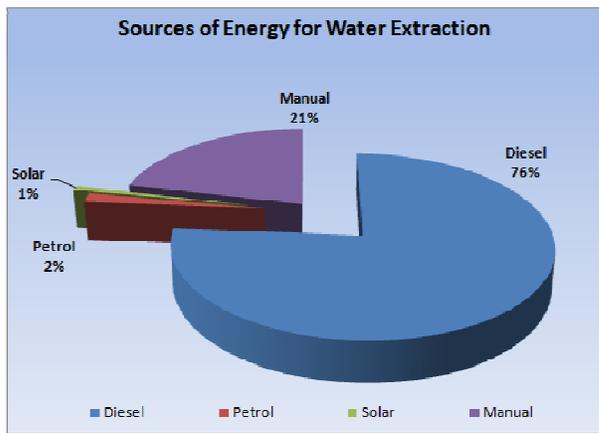


Figure 5: Sources of energy used for extracting underground water for livestock consumption (Statistics Botswana, 2012).

Integration is probably the most significant challenge as without it, a number of the opportunities identified in the section below may prove unattainable. Education, training, entrepreneurial capacity, sectoral programmes (agriculture, water, transport, tourism, etc) need to coordinate in setting the agenda for sustainable energy services. For instance, with acute water shortages Botswana is yet to face, exporting coal-generated electricity is in part, exporting water and the gains need to be assessed more critically; technology transfer requires artisanal capacity as has been

experienced with the solar industry and without it the technology fails to gain market penetration; reductions in petroleum consumption will be made not through the energy sector but the transport sector. These examples demonstrate the importance of integration and coordination to achieve the energy targets we set as a country.

Opportunities

Botswana's domestic energy-related resources present immense opportunities for addressing her energy insecurities and increasing access to energy services. The abundance of sunlight, coal and cow-dung forms the basis of such opportunities. The most significant input is the technology required to leverage the energy latent in these resources.

Solar Energy

Solar energy in Botswana amounts to over 3,200 hours/annum with a strength of 22Mega Joules per hour (MJ/hr) – representing one of the highest solar strengths in the world. Adoption of solar has been slow due to a number of barriers including technology uptake, low wattage output, costs and familiarity. These have been addressed through the assistance of United Nations Development Programme and the Global Environment Facility giving rise to BPC-Lesedi. The support also helped develop a curriculum for artisanal level, now awaiting inclusion into training

programmes. Costs have been addressed through government's capitalisation of BPC-Lesedi although the scale limits a wider roll-out. Problems of perceptions are still obstructing the wider use of solar and are exacerbated by the mismatch in prices between solar and grid services which are themselves a reflection of the differences in government subsidy between the two services. The current fiscal incentives in energy generation are higher in grid, resulting in a seemingly low consumer price than that charged by renewable energy service providers such as BPC-Lesedi. Due to the expanse of the country and the small population-size in many of Botswana's villages, off-grid electricity generation offers better returns using a hybrid of solar and biogas where appropriate. The hybrid solar-biogas provides for the peak 7-8pm energy demanding wherein solar alone would require extensive investments in battery-banks for storage.

Biogas

With a cattle population of 2,220,000 in 2008 (Statistics Botswana, 2012), the volume of cow-dung may be enough to run a number of stand-alone power-plants in hybrid arrangement with solar farms. This is an area requiring further investigation preferably by the Botswana Technology Centre. Other avenues for generation of biogas are the abattoirs and sewage treatment plants. Methane capture also presents opportunities not only for reducing GHGs but also addressing the country's energy needs. Methane capture has been considered by a number of private sector entities but met with challenges of ownership and lack of a concessions policy for landfills. The absence of waste-separation at-source also limits the profitability of methane capture, especially with the relatively low volumes of food-waste generated.

Fuel wood

Botswana's forest resources though not extensive, offer opportunities for supporting the demand in fuel wood if combined with technology enhancements. Inventories of wood resources and their production rates is an immediate need. Devolution of management and user rights (as done for wildlife) is equally urgent to ensure that those with more to lose have more to say in the management and use of the wood resources. Research, science and innovation carry opportunities for the application of such methods as selective pruning which has been found to enhance the growth of trees and provide fuel wood for communities. The use of wood-efficient stoves is also believed to be effective in reducing the rate of consumption of fuel wood and thus saving women and children the time spent in collecting fuel wood. BPC-Lesedi has, as part of their integrated energy services product-range, a model of wood-efficient stoves on a retail basis. The company also retails heat-retention bags which reduce the further need for fuel wood once the pot and contents are heated – a cooking method appropriate for slow-cooking dishes such as stews, oxtail, seswaa, samp and beans.

Sustainable Transport

Transport is the highest consumer of petroleum products, especially petrol and diesel. Non-Motorised Transport and the wider transport policy agenda harbour further opportunities for Botswana's Green Economy. The statistics on ratio of cars to total number of vehicles and the levels of consumption of petrol are an indication of an unsustainable development path. The scale-up of the public transport system as an alternative to using private cars presents opportunities for an efficient urban transport system in Botswana. This thinking permeates the draft Botswana Integrated Transport Policy. The options vary from the sophisticated rapid bus transport system to elementary changes such as dedicated lanes for mini buses and increased signage (at bus stops) depicting which bus-route passes where. Barrier studies in other countries have shown that more people use public transport once signage is improved. With signage integrated with branding and advertisement, these can be done through private sector with no costs to the municipalities. The current revision of the Road Construction Manual is also an opportunity ensure that NMT facilities are integrated into the manual. Settlement planning has been identified as a barrier to the adoption of NMT as in the Botswana context, it promotes sprawl thus as identified in other cities (Qurshie, 2011), making travelling too long for NMT, i.e. in excess of 10km. The National Development Plan for 2010-2016 targets decentralising some transport functions to local authorities to allow for increased focus on such elements as non-motorised transport (Ministry of Finance and Development Planning, 2010).

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