An Overview of the Development of Botswana's Renewable Energy Policy Framework

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ABSTRACT

Botswana is a middle-income developing country in Southern Africa with an economy mainly reliant on mineral resources, particularly diamonds. Other sectors of the economy like energy are trailing behind in this country's development. For a long time, Botswana has been relying on imported energy from her neighboring countries. Due to this great dependence, the country has had little control over sufficiency of energy supply, especially during times of shortages in the neighboring countries. As a result, Botswana came up with a number of initiatives over the years to ensure security of supply and self-sufficiency in the energy sector. However, even with the efforts made, currently Botswana is still not self-sufficient and is facing challenges of energy shortages mainly in the power sector. This paper therefore, seeks to review the various policy instruments that have been adopted in Botswana from 1996 to date, identify challenges that come with them and make recommendations on the identified challenges.

INTRODUCTION

BOTSWANA is a landlocked country situated in the southern part of Africa sharing borders with Namibia, Republic of South Africa (RSA), Zimbabwe and Zambia. For many years, Botswana has been highly dependent on her neighbors, especially RSA for energy supply. This has somewhat given rise to biasness of the country's energy-related efforts being skewed towards ensuring security of supply and self-sufficiency.

Although well-endowed with energy resources like solar and coal, which offer considerable potential to provide significant energy supply to reduce dependence on imported energy, Botswana's energy sector planning appears to be focusing on the supply of electricity and importation of petroleum products as opposed to exploring and developing the abundant alternative energy resources.

This paper explores a series of energy policy measures that Botswana pursued over half a century of its economic development, growth and stabilization. The purpose of this paper is to evaluate the efforts made in terms of policies and strategies and make recommendations on how to develop and implement efficient and cost-effective energy policies as a high priority area of the policy agenda to pursue national economic growth for the country.

DEVELOPMENT OF THE ENERGY SECTOR

Currently, there is no existing National Energy Policy that guides and directs development of the energy sector in Botswana. Initially, the sector was guided by Botswana Energy Master Plan (BEMP) of 1996, which was further revised in 2003 to allow for changes that had effected in the sector over the years. The reviewed Energy Masterplan[1] stipulated energy goals that would be used to support national socio-economic goals such as reduction of poverty and industrial development, which were at that time emphasized in the country's nineth national development plan (NDP 9) and Vision 2016.[2,3]

These national documents outlined four overriding national development goals being (a) Sustainable Development, (b) Rapid Economic Growth, (c) Economic independence and (d) Social Justice. As such, this led to corresponding energy goals being crafted towards securing a cost effective and diversified supply mix, highlighting the linkages between the energy situation of the 2000s and achievement of the intended national goals.[1]

Ensuring Energy Security

In the early years of development, construction of power plants seemed costly as opposed to importing electricity from the neighboring countries hence investment in expensive power plants was not a priority to the government then. Owing to this, until 2012 Botswana had only one local power plant, Morupule Power Station, owned by the national utility Botswana Power Corporation (BPC). Morupule Power Station produced only 132 MW which was not enough to meet the country's demand. Therefore, BPC imported approximately 80% of power from Eskom, the South African utility, to meet Botswana's electricity demand. The policy decision of not investing in power plants in the 1990s was solely based on cost-effectiveness.

Over the years, the cost of imported electricity became high, impacting negatively on Botswana's balance of payments. Currently, the tariff for imported electricity is more than double the cost of local electricity production.[4] According to statistics provided by the Department of Energy, Botswana's current electricity demand is estimated at 681 MW, expected to grow to 1017 MW by 2025.[5] The escalation in the cost of imported electricity coupled with increased power shortages in the 2000s has forced the government of Botswana to revisit its decision of highly relying on imports to ensure security of supply and still maintain least-cost strategy.

In 2006 the government considered increasing local production through expansion of the Morupule Power Station. Morupule B, a 600 MW (four 150 MW units) coal fired plant was constructed with a view to provide sufficient power to meet local demand and have excess power for export into the region. This plant was expected to be fully completed by 2012 but has not been fully operational to date, due to technical faults. This has forced BPC to continue importing highly priced electricity from Eskom. According to the Draft Energy Policy[5] the government's plan is to further increase local power production by developing a brownfield 300 MW plant and an additional greenfield 300 MW from independent power producers (IPPs).

Since inception, BPC has been a monopoly in the energy sector, being in charge of generation, transmission and distribution with no private sector participation. From literature, it is evident that the absence of a regulatory framework to promote partnerships and private sector investments in the energy sector significantly inhibits growth in the sector.[6,7] On this note, the Electricity Supply Act was amended in 2007[8] to allow for independent power producers in order to increase Botswana's generation capacity by opening up electricity generation. Nonetheless, even with this amendment of the Act, there is still no IPP participation in Botswana's power sector to date.

Environmental Protection

Following the United Nations Framework Convention on Climate Change (UNFCCC) in June 1992, the Kyoto Protocol came into effect in 2005, and there has been subsequent evolution of international regulation regime on greenhouse gas (GHG) emissions. This evolution ended with the Paris Agreement which was adopted by 197 countries in December 2016, including Botswana.[9,10] All these efforts are geared towards reducing GHG emissions into the atmosphere, especially carbon dioxide (CO_2) emissions.

According to Botswana's Second National Communication major sources of Botswana's air-pollution are from energy production and energy use in households and automobiles.[11] Fig. 1 shows the increase in CO_2 emissions between 1982 and 2010 according to the World Bank collection of development indicators.

The graph shows a relatively steady increase in

Fig. 1. Botswana's carbon dioxide emissions. World Bank

CO_2 emissions from 1982 to 2009. According to the Second National Communication[11] between 1994 and 2000 CO_2 emissions increased by about 74%. Therefore, as an effort towards meeting the global goal of reducing GHG emissions Botswana needs to come up with measures that will ensure a reduction rather than an increase in her emissions.

For an economy like Botswana, which consumes a notable amount of carbon-rich fossil energy, the realization of low-carbon energy system is an imperative for further economic prosperity. Botswana has always been cautious about the environment as observed in the initial policy instrument.[1] This is also supported by the submission of an Intended Nationally Determined Contribution (INDC) towards the global goal of reducing GHG emissions. According to the INDC, Botswana intends to achieve an overall emissions reduction of 15% by 2030, taking 2010 as the base year.[12]

A number of projects have been identified in the energy and transport sectors' infrastructural developments and their contributions towards CO_2 emission reductions have been quantified. If implemented accordingly, these projects will help Botswana achieve her desired emissions reductions as per the INDC.

Solar Energy Development

Renewable energy is currently seen as a key solution to both the issues of energy security and climate change[13] even in Botswana where for a long time, no policies had been adopted to promote renewable energy development. Development in this regard has been very slow mainly because the government's planning was centered only on supply. However, to keep up with global trend, the government of Botswana has employed some measures to promote uptake of renewable energy sources, although these were not guided by any defined policies.

Botswana possesses one of the highest solar potentials in the world, estimates of about 3,200 hours of sunshine per year.[14] Based on satellite estimation, solar irradiation in Botswana is abundant throughout the country as shown in Fig. 2 below.[14] However, despite this abundance, the contribution of solar to the current energy mix is very insignificant, less than 1%.

In 2005 a Renewable Energy-Based Rural Electrification programme was carried out by the government in order to increase the use of solar energy through provision of solar home systems for cooking and lighting in some rural villages.[15] This programme did not achieve its anticipated result, which was to reduce Botswana's energy-related CO_2 emissions by promoting renewable and low GHG technologies as a substitute for fossil fuel in rural areas.

To date, large-scale application of solar in Botswana has been limited to only 1.3 MW grid-connected

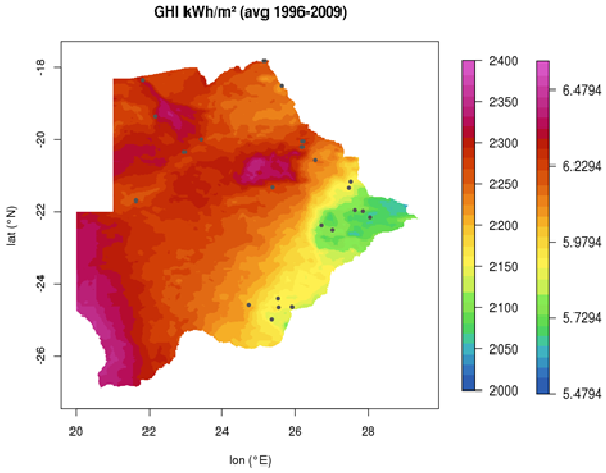

Fig. 2. Total amount of shortwave radiation received (Global Horizontal Irradiance) using satellite data from 1996-2009.

solar farm in Phakalane, which was commissioned in 2012 in collaboration with the Government of Japan. Another grid–connected system includes the recently constructed, but not yet operational 20 kW research system installed in Mokolodi village by the University of Botswana. On this note, it is clear that robust policy steps are needed in order for solar energy to take–off in Botswana.

In 2016, the government developed a Renewable Energy Strategy which is intended to drive the development of the country's renewable energy sector. The strategy stipulates a target of 18% contribution of solar to the energy mix by 2030,[14] a target that is highly ambitious considering the current contribution of less than 1%. Therefore, to achieve this, the government should come up with bold steps and defined plans to promote the development of solar.

DISCUSSION

As outlined in this document, the efforts to develop solar are very minimal in Botswana despite the abundant resource. In order for Botswana's renewable energy sector to develop effectively and contribute significantly to the economy of the country, there is need for the government to take a firm position on the direction that is deemed priority in the energy sector development and come up with policies that are in line with achieving the set goals. In this regard, solar can be prioritized because its effective development will address the country's existing challenges of energy security and climate change. This approach can guide efficient utilization of available limited resources proficiently.

The development of the Botswana Renewable Energy Strategy (BRES) in 2016 can be viewed as a positive initial step towards solar development. If implemented accordingly, BRES can guide development of renewable energy in a directed manner since it has a set target for solar adoption [19]. However, in order to achieve the ambitious target of 18% renewable energy contribution to the energy mix by 2030, a lot has to be done. This calls for development and implementation of strategic projects in the renewable energy, particularly solar.

Renewable energy development goes side by side with technology hence it is imperative to work with or set up dedicated institutes for energy technology research and innovation, both in state–owned and private sector organizations. Such institutes can be mandated to carry out researches which are in the interest of the government, in line with the energy plans. At the moment Botswana relies 100% on imported technologies which may not necessarily be the best for local consumption hence the importance of enhancing research and technology development. Specific technology projects should be identified and specific objectives for such projects be set and promoted through these institutions under defined long–term strategies running parallel to the energy development plans.

Mechanisms of ensuring effective project implemen–tation should also be put in place by the government. From this review it is evident that most intended projects are either not delivered on schedule or if delivered, they do not give desired outcomes.

Apart from a limited number of large–scale national development projects, investment choices should be

left to private sector initiatives with the government only availing the general framework and direction to guide the development. If possible, the government should also reduce intervention in market mechanisms by minimizing regulation and adopting various new incentive systems to foster creative efforts in the private sector. For instance, the government should consider eliminating monopoly in the power sector.

CONCLUSION

Diversifying energy supplies, provision of reliable energy services and ensuring affordable energy prices, whilst protecting the environment through actions against climate change are considered key issues for Botswana. Therefore, it is prudent to have a defined pathway through defined policies for these goals to be realized. Botswana should develop and adopt an Energy Policy Framework that will guide development of the sector in an efficient and effective manner.

ACKNOWLEDGMENT

The author acknowledges Korea University for enrollment and support to pursue a Ph.D. in Green Energy Technology Policy Professionals Program and staff of Botswana Department of Energy for providing information regarding the energy sector situation in Botswana.

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