

Financing Mechanisms for Refrigerators and Distribution Transformers in Botswana

February 2022

Contents

- 1. INTRODUCTION..... 3**
- 1.1. BACKGROUND 3**
- 1.2. THE ELECTRICITY SECTOR 3**
- 2. ENERGY EFFICIENCY IN PERSPECTIVE 9**
- 2.1. ECONOMIC BENEFITS OF ENERGY EFFICIENCY 9**
- 2.2. THE FINANCING PROBLEM FOR ENERGY EFFICIENCY10**
- 3. ENERGY EFFICIENCY FINANCING MECHANISMS 12**
- 3.1. OVERVIEW 12**
- 3.2. FINANCIAL MECHANISMS FOR REFRIGERATORS 13**
- 3.3. FINANCING MECHANISMS SUITABLE FOR DISTRIBUTION TRANSFORMERS..... 17**
- 4. CONCLUSION..... 23**
- REFERENCES 25**

©CLASP, APRIL 2020

CLASP makes no representations or warranties implied. The work presented in this report represents our best efforts and judgements based on the information available at the time this report was prepared. CLASP is not responsible for the reader’s use of, or reliance upon the report, nor any decisions based on this report. Readers of the report are advised that they assume all liabilities incurred by them, or third parties, as a result of their reliance on the report, or the data, information, findings and opinions contained in the report.

1. INTRODUCTION

1.1. BACKGROUND

Botswana is a Southern African country with a middle-income economy based primarily on mineral resources, principally diamonds. Botswana is 581,730 square kilometers in size, with 566,730 square kilometers of land and 15,000 square kilometers of water. According to the World Bank, Botswana has a population of 2.3 million people with a Gross Domestic Product (GDP) of 15.3 Billion US dollars. It has 7,000 dollars GDP per capita.

Energy plays a critical part in a country's socioeconomic development. The ability to harness energy is critical to Sub-Saharan Africa's socio-economic development and ability to combat climate change. Electricity, petroleum products, and coal dominate Botswana's traditional energy sector, while renewable energy sources such as solar, wind, and geothermal energy are largely untapped. Electricity is accessible to 65 percent of the population, with 81 percent in urban areas and 28 percent in rural areas.

Botswana's electricity demands is at 4505 GWh which is largely generated from thermal power plants. Botswana generates 3142.85 GWh from Morupule A and Morupule B coal thermal power plants. The electricity generated from these two thermal power plants are augmented by two diesel-operated peaking plants which generate 160MW. Botswana has become more reliant on electricity imports, particularly from South Africa as a result of shortfalls in their electricity production capacity.

Higher electricity generation will most certainly result in higher energy sector emissions since Botswana is over reliant on coal for electricity generation. Higher emissions will set the country back in Nationally Determined Contribution (NDC) commitments to reduce Green-House Gas (GHG) emissions. One option to mitigate this is to adopt energy efficiency, and one way to achieve energy efficiency is through development and enforcement of minimum energy performance standards (MEPS).

1.2. THE ELECTRICITY SECTOR

This section is going to analyze the efficacy of legal, institutional and policy framework in regulating energy efficiency and conservation in the electricity subsector in Botswana. There are several instruments that regulate the energy sector in Botswana.

1.2.1. INTERNATIONAL INSTRUMENTS:

The main goal of this instrument is to promote access to renewable energy while also promoting energy efficiency. The agenda's action points encourage the development of tiered standards for efficiency of appliances. Botswana had committed to 10% power savings by 2020 through energy efficiency and conservation initiatives (Mooiman et al., 2016). Botswana has tried to meet this ambition through: Promoting the use of Compact Fluorescent (CFL), use of hot water load control, carrying out efficiency awareness campaigns, and promoting the use of energy efficient stoves (Sustainable Energy for All, 2020)

1.2.2. LOCAL INSTRUMENTS

This is the principal statute that regulates electricity distribution in Botswana. It principally deals with licensing of generation, supply, importation or exportation of electricity and distribution of electricity in the Country. This Act does not have provisions on the regulation of efficiency in the generation, distribution and use of electricity.

1.2.2.1. BOTSWANA POWER CORPORATION ACT

This statute establishes the Botswana Power Corporation (BPC) for the generation and distribution of electric power, as well as providing for things incidental and connected with the electricity subsector. Under Section 13 of the BPC Act, the functions and powers of BPC are prescribed. BPC is vested with powers of giving directives for the manufacture of appliances that may make the delivery of its functions efficient. This includes developing directives for the manufacture or importation of energy efficient electrical appliances.

1.2.2.2. BOTSWANA ENERGY REGULATORY AUTHORITY (BERA) ACT

This statute establishes the Botswana Energy Regulatory Authority (BERA) in section 3 of the BERA Act. It outlines the powers and functions of BERA in sections 6 and 5 of the BERA Act respectively. The Act mandate the powers and function of BERA shall be undertaken by a board consisting of 4 permanent and 4 part time members appointed by the minister (Botswana Energy Regulatory Authority Act, 2016). According to section 26 of the Act, the Authority is financed through funds allocated by the National Assembly, fees that the Authority may impose for services, fees charged for issuance of licenses, endowments from any other source and monies borrowed with the approval of the Minister responsible for finance.

The Act also covers licensing of regulated operations, such as electricity generation, transmission, and distribution (Botswana Energy Regulatory Authority Act, § 35 (2016). The Authority is in charge of

ensuring sustainable and secure supplies in the regulated sector, as well as creating and maintaining service standards, safeguarding and preserving the environment, and ensuring that the energy industry is controlled in accordance with best international regulatory practice (Botswana Energy Regulatory Authority Act, § 5 (2016)). The Authority is responsible for developing and maintaining a nondiscriminatory and efficient regulatory framework that all regulated organizations and licensees in the regulated sector must adhere to (Botswana Energy Regulatory Authority Act, § 4 (2016)).

1.2.3. INSTITUTIONAL FRAMEWORK IN THE ELECTRICITY SECTOR IN BOTSWANA

1.2.3.1. MINISTRY OF MINERAL RESOURCES, GREEN TECHNOLOGY AND ENERGY SECURITY

This ministry is in charge of developing, directing, and coordinating the country's overall mineral, green technology, and energy security strategies. The Department of Energy is responsible for developing the country's policy, legal, and regulatory framework for energy supply and demand management (Danish Energy Management & Esbensen, 2017). The organizational structure of the Department of Energy (DoE) reveals pathways of involving government in adoption of energy efficiency appliances in the electricity sector. The DoE has two directorates; the programme development directorate and the policy, research and planning directorate.

The relevant desks include Energy Regulation desk and Policy Desk in the directorate of policy, research and planning. These two desks will be key in the development of policy instruments governing standards of energy efficient electrical appliances. The relevant desks in the programme directorate are the Electricity desk and the Energy and Conservation desk. The programme directorate will be vital in the development and implementation of energy efficient appliances programmes that may be developed.

1.2.3.2. BOTSWANA ENERGY REGULATORY AUTHORITY (BERA)

BERA is the regulator of the energy sector in Botswana. It is an autonomous agency tasked with ensuring the economic sustainability of energy supply, establishing tariff regulations, and monitoring supply efficiency (Danish Energy Management & Esbensen, 2017). Electricity, petroleum products, natural gas, coal, bio-energy, solar energy, renewable energy resources, and other energy resources are among the regulated sectors (BERA, 2021).

The Authority has power to review energy tariffs in the electricity sector. The Authority's tariff review process aims to guarantee that energy prices are cost-effective since this will encourage greater investment in the sector, as well as the utility's long-term service provision and efficient use of electricity (BERA, 2021). The Authority is well poised to develop regulatory mechanisms that can streamline energy efficiency of appliances in the country as the authority is tasked with setting and maintaining service

standards under section 5 of the BERA Act. The authority is also responsible for protection and preservation of the environment in the delivery of its functions (Botswana Energy Regulatory Authority Act, § 5 (2016).

1.2.3.3. BOTSWANA POWER CORPORATION (BPC)

The BPC is Botswana's power utility responsible for generation, transmission and distribution of electricity. BPC is a government entity established under the BPC Act. BPC is the sole distributor of electricity in Botswana. In addition to the power to generate electricity, BPC has the power to sell electrical appliances or fittings as provided for under Section 13(n) of the BPC Act. This provision underscores how vital BPC is in the energy sector. The BPC can play a pivotal role in undertaking any strategies gearing towards deployment of energy efficient appliances. Partnership between private sector actors, civil society and the BPC is crucial for the sale and distribution of energy efficient appliances since BPC already has a nationwide distribution infrastructure in place. The other key players in the electricity industry in Botswana are Consumers, Independent Power Producers (IPPs) and the Southern African Power Pool (SAPP).

BPC is also charged with developing by laws for regulating the electricity sector. BPC (electricity) By-Laws were developed to regulate the electricity sector under the powers delegated by the BPC Act. Customers must use their power supply in such a way that it does not interfere with the efficient and economical supply of electricity to other consumers, according to Section 27(4) of the By-Laws. This relation tasks consumers with efficient use of electricity under their own independent undertaking.

1.2.3.4. BOTSWANA BUREAU OF STANDARDS (BOBS)

The Botswana Bureau of Standards (BOBS) is established under section 3 of the Standards Act of 1995. Under Section 3(2)(a) of the Standards Act, one of its main responsibilities is to promote standardization and quality assurance in industry and commerce, with the goal of enhancing product quality, industrial efficiency and productivity, and trade development. Standardization work is carried out at the national level by standards committees, which might enlist the help of expert groups (BOBS, 2021). These committees or working groups are made up of qualified individuals from the private sector, research institutes, government agencies, consumer organizations, and professional organizations (BOBS, 2021). BOBS can make an impact on the standardization of energy efficiency of electrical appliances through government support and industrywide cooperation. Electrical appliance standards and labeling are critical tools for SADC countries to achieve greater energy sufficiency (REN21, 2015, p. 21).

1.2.4. POLICY FRAMEWORK IN THE ELECTRICITY SECTOR IN BOTSWANA

1.2.4.1. THE INTEGRATED RESOURCE PLAN (IRP)

The IRP underpins Botswana's least cost development plans for the energy sector for the next two decades. It is geared towards the country's self-reliance for its electricity needs. Furthermore, one of its main goals is the development of energy efficiency improvements in the electricity subsector. The rationale for this goal is that energy demand management measures need to be undertaken because it is projected that Botswana's population will grow by over 38% by the year 2040.

The IRP also champions for diversification into generation of clean electricity to augment electricity generated from coal. Consequently, Botswana aims to achieve energy security in addition to mitigating environmental impact of GHG emitted from generation of electricity through implementation of the IRP.

1.2.4.2. THE NATIONAL ENERGY POLICY (NEP) OF 2021

The NEP sets out an ambitious plan to achieve energy sufficiency through the exploitation of renewable sources of energy. Under the NEP, energy efficiency and conservation actions will be given primacy in terms of any relevant support with the goal of reducing energy waste and offsetting emissions from electricity generated from coal and diesel (Ministry of Mineral Resources, Green Technology and Energy Security, 2021). The NEP was developed to keep pace with Botswana's current energy needs as the Botswana Energy Master Plan (BEMP) which was last reviewed in 2002 was not efficient in addressing the present needs and ambitions of the country. The NEP was designed to inject affordability, increased access, energy security and environmental protection in the energy sector.

The NEP highlights the challenge of importation of electricity. It projects that by 2025, importation of electricity will be miniscule reducing as a result of electricity generated at Morupule B power plant. Successful completion of Morupule B power plant will raise the country's power generated annually to 4,369 GWh against a 4,505 GWh demand. This is expected to bolster the country's energy security.

The NEP acknowledges that a lot of energy is wasted at different stages of energy flow which stems from inefficient energy systems. Efforts aiming at bolstering energy efficiency in the country include adoption of a step-tariff Model by BPC in 2010 and compact fluorescent bulbs (CFLs) in selected households. The NEP notes efforts aimed at reducing energy wastage have subsisted despite the lack of significant regulatory instruments imposed by the government. The NEP calls for the development of a legislation that promotes the adoption of energy-efficient appliances and equipment. The NEP undertakes to promote

clean energy extraction, production, transport so that Botswana can keep pace with its ambitious NDC to reduce GHG emissions by 15% by 2030.

1.2.4.3. THE NATIONAL ENERGY EFFICIENCY STRATEGY (NEES) OF 2019

The National Energy Efficiency Strategy (NEES) for Botswana was developed in 2018 with the goal of addressing bottlenecks, resource limitations, a lack of policy integration, and accountability in the energy sector (Ministry of Mineral Resources, Green Technology and Energy Security, 2021). The main goal of this policy instrument is to provide a pathway for energy conservation in Botswana. It lists actionable both short-term and long-term recommendations that the government can implement in its pathway to energy efficiency.

The NEES recommends the introduction of Minimum Energy Performance Standards (MEPS) for equipment in addition to development of standards and labelling of appliances. Moreover, it calls for capacity building particularly for enforcement personnel. The NEES goes further to recommend the introduction and tightening of MEPS in other sectors of the economy such as the mining sector, the manufacturing sector, the agricultural sector and the transport sector.

2. ENERGY EFFICIENCY IN PERSPECTIVE

Energy efficiency has been touted to be a key factor in the socio-economic development of the Sub-Saharan Africa. Energy efficiency is at the nexus of climate change and sustainability. It can be achieved using legal, institutional and policy regulatory instruments. Energy efficiency instruments achieve their objectives through different types of interventions: the first is by establishing minimum energy performance levels; the second is by using 'price' incentives; and the third is by attempting to improve awareness of energy-related issues such as appliance use and the existence of energy-efficient methods of use.

In most industrialized nations, technical advancements combined with suitable energy efficiency policies such as the establishment of Minimum Energy Efficiency Performance Standards (MEPS) have fueled a massive change in appliance efficiency (Asinyaka, 2019).

In order to reduce energy losses, actions such as the adoption of performance standards, setting minimum efficiency levels, informing customers, creating differential tariffs and financing efficient appliances appear to be amongst the most effective and widely adopted schemes (Cardoso et al., 2010).

In the case of African countries, the inefficient nature of appliances, many of which are old and used models imported from Europe and other rich countries might be attributed to many African countries' excessive energy consumption for refrigeration for instance.

Energy efficient appliances have high first costs. To overcome first-cost barriers to market acceptance, policymakers and institutions must be involved, and deploy financial resources to assist a market transition to efficient appliances (GEF & U4E, 2017b). Financial incentives are frequently required to enable a market transition to energy efficient appliances. To achieve market transformation, countries must adopt a strategy that aids in the removal of market and other barriers, boosts local investor confidence, and mobilizes private sector investment and involvement. Governments can achieve this goal by fostering an enabling economic climate that makes it easier to buy and install energy-efficient appliances such as transformers (GEF & U4E, 2017b).

2.1. ECONOMIC BENEFITS OF ENERGY EFFICIENCY

From a national perspective, it is estimated that the cost of implementing energy efficiency measures is less than the cost of supplying additional energy. The surplus funds that would have been used to meet energy needs is then diverted to augment meeting other basic needs (Munene et al., 2019). Efficient

consumption of energy helps achieve energy security and reduce dependence on imported fuels (Harutyunyan & Sassi, 2017).

For consumers, the life cycle cost of efficient appliances, which include the energy cost of operating the appliance over its life, are usually less than that of inefficient appliances, other factors being equal, despite the higher first cost of efficient appliances.

Furthermore, efficient appliances result in lower CO₂ emissions, which mitigates global warming and enables countries such as Botswana to meet its NDCs.

Energy efficiency mechanisms are used as a measure of meeting energy needs while concurrently reducing the energy costs of consumers. Energy efficiency is therefore a key tool for achieving socioeconomic sustainable development.

2.2. THE FINANCING PROBLEM FOR ENERGY EFFICIENCY

The increased efficiency of an appliance is not always enough to economically justify its adoption, because the degree of use, ambient aspects, appliance price, financing costs and energy cost all have a role. Many customers lack the financial means or willingness to spend their limited financial resources on higher first costs (State and Local Energy Efficiency Action Network, 2014). Furthermore, energy cost reductions of the high quality appliances are realized in the long-term rather than immediately (Magallón et al., 2019). These two factors discourage consumers from investing in energy efficient appliances.

Different energy efficient appliances require financing mechanisms that are tailor made to suit specific needs. Lack of access to appropriate or affordable financing mechanisms is a major impediment for many end-users (Magallón et al., 2019).

1.7 billion adults around the world do not have a bank account or use a mobile money provider, and hence cannot be served by financing mechanisms that are widespread in countries with high rates of financial inclusion. End users who do have access to these financial services may be unable to obtain credit due to a lack of collateral, or may be discouraged from investing due to unfavorable loan terms, such as high interest rates or short terms (Magallón et al., 2019).

However, given the economic benefits energy efficiency, it is worthwhile to examine and promote energy financing mechanisms capable of lowering these economic obstacles and increasing the appeal of more efficient equipment (Cardoso et al., 2010).

The EE financing market has seen a significant increase in interest and activity over the last few years. The high initial cost of more efficient equipment can be solved with easy access to competitive financing as compared to standard finance products (Deason et al., 2017).



3. ENERGY EFFICIENCY FINANCING MECHANISMS

3.1. OVERVIEW

Financing is a critical tool for entrenching energy efficiency practices in various sectors. There are multiple energy financing approaches for enhancing energy efficiency. Each approach is designed to facilitate access and lower the cost of acquiring energy efficient appliances. This study evaluates financing mechanisms for energy efficient domestic refrigerators and distribution transformers. Financing mechanisms adopted for high efficiency refrigerators are largely driven by the private sector whereas those mechanisms of financing distribution transformers fall in the public sector as most power utilities are government owned.

Despite the fact that financing mechanisms are a critical tool for achieving energy efficiency, it is noteworthy of the fact that financial aid alone is ineffective in addressing many market problems. Therefore, it is critical that any approach be designed with other measures in mind, such as synchronized technical assistance and publicity campaigns (EBRD & EC, 2020).

Some financial products have unique features that have the potential to address both the high initial cost barrier and other barriers which contribute to customer underinvestment in energy efficiency in specific customer segments (State and Local Energy Efficiency Action Network, 2014). Energy efficiency funding schemes can help in a variety of ways. such schemes include:

1. Grants given before or after purchase;
2. Schemes for tax relief, accelerated depreciation, and tax rebates;
3. Direct loans (which may be supplemented by subsidies) with lenient terms facilitated through energy efficiency funds;
4. Commercial bank credit lines for tied loans;
5. Providing financial help for energy savings through third parties such as Energy Service Companies;
6. The provision of financial guarantees;
7. On-bill financing with flexible terms.

In comparison to what would be available on the open market, each of the choices tries to lower the cost burden on the end consumer of implementing an energy saving solution (EBRD & EC, 2020). Aside from the type of finance mechanism used, schemes can be classified at a high level by two additional policy design characteristics.

1. The source of funding: general taxation, donor cash, energy bill levies, carbon allowance earnings, or other consumer fees and penalties.
2. The allocation procedure, which could be pre-selected, auctions, multi-criteria tenders, or first-come, first-served.

3.2. FINANCIAL MECHANISMS FOR REFRIGERATORS

According to case studies, a large amount of money has been spent on energy efficiency. These expenditures have resulted in significant reductions in emissions and energy use, and in some situations, the finance levels are comparable to supply-side investments. Financing cooling efficiency, on the other hand, has a number of success factors, including (Carbon Trust, 2018);

1. Ensuring take-up, eligibility criteria is designed
2. The likelihood of a rebound effect, resulting in increasing energy use, which at its most might cancel out any efficiency gains
3. The significance of creating awareness in order to increase participation
4. In bulk procurement-based systems, ensuring the necessary degree of competition and scale
5. Assuring that the technical supply chain is adequate to sustain initiatives
6. Understanding and ensuring the leveraging of additional financing derived from public sources
7. Energy Service Company (ESCO) models are being used efficiently to ensure energy and cost reductions.

It is necessary balance the goals of closely matching solutions with barriers and keeping schemes simple and easy to use in the design of financial mechanisms (Carbon Trust, 2018). A review of the possible financing mechanisms of refrigerators is detailed below.

I. Dealer Financing

Energy efficient technology companies offer financial assistance to their residential consumers through dealer financing. This mechanism adopts a credit-based approach where the customer of the energy efficient refrigerator will get an appliance then customer pays the credit subsequently with or without a deposit. The key players in this financing model are energy efficient technology providers, financial institutions and buyers.

Dealer financing approaches are of two types, indirect and direct credit dealer approaches with the latter being more common. The credit tenure of direct loans ranges from 30 to 180 days. A bank or a third-party

financial institution can purchase the credit portfolio. The appliance supplier facilitates the credit application by undertaking data collection from the prospective purchaser and transferring the application to a lender in the indirect lending model. The lender then evaluates the application and provides a credit quote (Magallón et al., 2019).

This model is vital in providing access to energy efficient appliances where credit access is limited particularly in the global south. However, most appliance dealers may not have the capacity to undertake this strategy successfully. Dealers utilizing this financing model should therefore be supported through credit provision by energy efficient technology providers.

II. Microfinance/Credit Line

The provision of financial services to low-income households through small transactions is known as microfinance. Due to high transaction costs, perceived risks, low profits, and a lack of security, Microfinance Institutions (MFIs) typically service sectors of the economy that the mainstream banking system considers unbankable. Models of microfinancing are diverse as they are designed to suit specific demographics.

Capital can be injected by a donor, Multilateral Development Banks (MDB), governments, or private organizations to a financial intermediary who can then lend to their clients. This provides a ring-fenced source of money that encourages lending, especially when offered at low rates or used to facilitate unsecured lending. The MDB gives money to local banks, who then deposit the money to MFIs to give green loans to eligible borrowers. The loans are then repaid by borrowers through small manageable payments over a reasonable period. This strategy requires robust donor engagement for it to realize significant successes.

MFIs have access to critical data on low-income households which can enable low-income households to realize energy efficiency through the purchase of energy efficient appliances to break their financial barriers to access these appliances. MFIs also play a key role in educating the masses on energy efficient technologies which aids in increasing uptake of these technologies by leveraging positive socio-economic impacts of these technologies.

Due to MFIs' rigorous qualifying criteria or perceived high interest rates charged, borrowers may feel tricked or uninterested in loan proposals, which is one of the model's primary challenges. Furthermore, MFIs may not be self-sustaining due to restricted funding sources, particularly for developing and selling

new products and services such as loans for energy efficiency systems. Also, MFIs frequently lack the technical capacity to evaluate reliable technology providers and cost-effective technologies, resulting in missed possibilities for cost effective primary energy savings and GHG emission reductions. This strategy requires high technical assistance in order to continue operating after the initial.

III. Savings Groups

This strategy is a market-based savings-led financing mechanism in which self-selected individuals pool their savings and borrow loans with interest from those savings, then split the gains. Members own, administer, run, and regulate them themselves. Members of savings groups have the chance to save frequently in small amounts, as well as have access to flexible lending and some basic insurance. This strategy is better suited to low-income urban residents, peri-urban middle-income residents, peri-urban low-income residents, and high-income rural residents. Savings groups augment MFIs. They are facilitated by NGOs, MFIs, and government agencies.

In comparison to the informal financial services available in villages and informal settlement communities, savings groups tend to be more organized, open, and democratic. They augment services provided by regulated financial institutions in addition to providing financial access to those locked out by the formal banking system. Moreover, savings groups are scalable. Savings clubs concentrate on mobilizing local capital to address local needs and developing low-cost self-regulated approaches.

Critics of this strategy argue that it is unsuitable due to its small capital base and low loan sizes. The fact that they are also unregulated has raised concerns as to whether this financing strategy is credible. This strategy is also over-reliant on subsidies to remunerate field officers during the early stages of savings group development. Finally, utilizing savings groups to address issues other than finances runs the risk of overburdening members with supply-driven activities rather than meeting their needs.

IV. On-Bill Financing

On-bill financing allows users to spread out the upfront cost of purchasing an energy-efficient appliance and balance monthly payments with the unit's energy savings. It entails integrating investment costs with existing bills, so that the former does not surpass the latter throughout the payback term (Carbon Trust, 2018). Participants in a Mexican case study can pay for the efficient unit with their electricity bills, which is a unique financing design. On-bill finance could be utilized to target many different customer segments

because most consumers are comfortable with paying their electricity bill, even if they are not accustomed with taking out a loan (de la Rue du Can et al., 2015). This finance mechanism is inclusive as it helps customers who have been locked out of the formal banking institutions as it broadens the eligibility criteria of prospective customers.

On-bill finance is a loan issued to a utility user, such as a homeowner or a business owner, with the revenues going toward energy efficiency improvements. Until the loan is repaid, the utility collects regular monthly loan payments on the utility bill (Henderson, 2013). An on-bill program can be run by the utility itself or in collaboration with an outside administrator (such as a state energy agency or another comparable organization). A program may be restricted to specific sorts of consumers, such as commercial property owners, business tenants, or residential property owners (Henderson, 2013). On-bill financing approaches can be structured in a variety of ways: one way is through the power utility bearing initial capital expenditure which will then be repaid by customers in instalments. The second is by a third-party providing the initial capital then the power utility will play the role of a debt collector for the third party. The third is through binding a debt to a property electricity meter rather than the proprietor of the property so that electricity tariffs can outlive occupancy of a property.

The two unique aspects of on-bill loans, the connection to utility service and the necessity of bill neutrality¹, can work together to provide significant benefits for some customers, resulting in increased adoption of energy efficiency measures. An on-bill loan expands consumer eligibility, provides institutions with a new way to invest in efficiency, allows more occupants to invest, and promotes market transformation. Customers of energy utility companies can buy energy-efficient appliances like refrigerators and pay for them over time with their monthly utility payments.

This financing strategy is not short of implementation challenges. The first impediment to implementation is getting the power utility to serve as a financier to energy efficiency transition of appliances. Ascertaining the credit worthiness of prospective buyers through their historical utility payments is a second challenge. Thirdly, changing the power utility's data management system to incorporate on-bill payment may also pose a challenge. Domestic electricity consumers also risk their power being cut off for failing to remit their burgeoned utility bill. Repayment allocation may pose a significant risk as electricity consumers have different capabilities owing to their income levels. The prospective buyers are also at risk of misinformation from the various contractors in this system.

¹ Meaning energy efficiency savings on monthly bills must be greater or equal to a customer's loan payments

V. Financial Incentives (Rebates, Tax Credits and/or Subsidies)

To increase demand for energy efficiency projects and/or the provision of finance for energy efficiency investments, the temporary business case for energy efficiency can be made more appealing through financial concessions or compensation. Financial incentives are intended to reduce the initial cost of energy-efficient appliances and to stimulate end-users to realize energy efficiency. Different financial incentive programs adopt different formulations and different amounts. Governments and power utility companies provide incentives to: encourage the deployment of energy efficient appliances identified through voluntary or mandatory energy efficiency labeling; assist manufacturers and resellers in meeting stricter mandatory energy efficiency standards; increase residential energy efficiency investments, or meet energy savings obligations. The most common types of financial incentives are rebates, tax credits, provision of subsidies and lowering of value-added tax on energy saving appliances. Carbon credits or government loan guarantee programs could be used to fund incentives (Magallón et al., 2019).

Incentives are a tried and proven strategy of encouraging market adoption of energy-saving appliances. They are appealing to consumers and can be cost-effective in terms of government spending. The most profound challenge is ensuring that financial incentives result in self-sustaining market changes that last after the incentive program has ended. Another obstacle for government programs is ensuring that public funds used for incentives are spent efficiently, socially, and responsibly. The other challenge is the loss of revenue for governments, albeit temporarily.

3.3. FINANCING MECHANISMS SUITABLE FOR DISTRIBUTION TRANSFORMERS

Commercially available technical solutions to improve transformer energy efficiency are available. The market for highly efficient transformers still has a lot of scope for advancement. In a few countries, policy measures are being implemented to encourage and assure higher adoption of energy efficient transformers, although the vast majority of markets are still untapped. The following are some of financial mechanisms that are frequently employed to purchase transformers:

I. Utility Regulatory Frameworks

Additional generation is required to compensate losses in the transmission and distribution system, which costs money and puts a burden on already restricted generating assets. Progressive regulatory regimes seek to strike an ideal economic balance between protecting end-user customers' interests and ensuring that the utility benefits from energy efficiency improvements in its own network. If network operators are

sufficiently rewarded, they will weigh the costs and benefits of decreasing losses and take steps to reduce losses as efficiently as possible, including purchasing energy-efficient transformers.

II. Guarantees

Guarantee instruments are meant to mitigate some of the risks associated with loan repayment. They seek to lower financing institutions' perceived risks in the short term while also increasing their technical and financial trust in certain energy efficiency programs over time. These programs function as specialized development agency interventions or revolving funds, or as part of the commercial banking system. Utilities and other end users of transformers who get access to a guarantee facility can use it to get loans at concessionary rates for procuring and installing efficient transformers. They can use the resulting loss reductions as sources of funds to repay the loans.

In many circumstances, International Financial Institutions (IFIs) or public agencies establish up and operate partial risk guarantee funds backed by the IFIs or government resources. These partial-risk guarantee funds enter into guarantee framework agreements with participating banking institutions, which then conduct necessary transactions with project developers or utilities seeking credit. These agreements spell out the eligibility requirements and provide assurances of assistance.

Loan guarantee programs which are backed by public funds, assist in covering anticipated high initial economic risks. Loan guarantees have shown to be particularly effective in situations where the banking system is relatively well-functioning and the key prerequisites for energy efficiency lending to thrive are already in place. Loan guarantee programs may not be acceptable in some circumstances since the main impediments to economically viable energy efficiency loans are not perceived high payback risks, but rather other concerns such as a lack of efficient processes to meet technical evaluation standards or market maturity.

III. Public Private Partnerships

Public-Private Partnerships (PPPs) are mechanisms that allow governments to fund and operate services through private-sector contracts. They are available in a number of formats and structures. Depending on the form of the partnership contract, finance can come from the public sector, the private sector, or both. The private sector provides its implementation experience to a project that is ordinarily regarded public, and it takes on much of the financial and performance risk (GEF & U4E, 2017b). PPPs are long-term contracts, generally 20 years or more, in which the private sector builds and maintains a project's physical assets while raising the necessary funds, usually through project finance, with the public sector's contractual payments serving as the principal security for funders. The overall purpose of PPPs is to reduce

the lifecycle costs of public assets while also ensuring that essential services are provided at a competitive price. Green credit lines and other sources of private equity, Energy Service Companies, and Energy Performance Contracts can all aid in the realization of the success of PPPs.

PPPs provide a platform for taking on large-scale projects using private-sector financing and management experience while maintaining management control and crucial decision-making authority. While this approach has not been employed for transformers, it is a possibility to consider (GEF & U4E, 2017b). A private company builds and maintains a public asset under a PPP. The public agency contracted under a PPP, on the other hand, undertakes to pay the costs over time, including the cost of capital, which is usually higher than if the project were funded entirely by the government. If the higher capital costs are mitigated by greater efficiencies elsewhere, such projects nevertheless provide more value to the public. This model may be appropriate for financing of distribution transformers in Botswana.

The fundamental advantage of a PPP over a traditional public procurement procedure is that optimal risk-sharing with a private partner provides greater value for the public user. PPPs provide policymakers with an opportunity to improve service delivery and facility management. Mobilization of private capital is another advantage. Demand for public services investment demonstrates that, even when supplemented with donor financing, government resources can fall short of the amount needed for public projects. PPP contracts, on the other hand, are more complicated than traditional public procurement practices.

IV. Energy Savings Performance Contracting through ESCOs

An ESCO is a company that offers a wide range of turnkey energy solutions, including upgrades to electrical systems in commercial and industrial buildings as part of a larger energy efficiency plan. ESCOs adopt the guaranteed savings model guarantee the energy savings (by taking on the technical risk) for any efficiency improvements made. Because their credit is utilized to acquire a loan to pay for the retrofit, the client assumes the credit risk. The client pays back the loan and the ESCO's services with the money they save on their power bill. In a shared savings model, the ESCO borrows money from a bank or invests its own money, taking on both credit and technological risk. Because each client's credit is leveraged rather than relying on the credit of the individual ESCO, the guaranteed savings model allows for more extensive projects and a higher number of projects to be completed. The performance of energy efficient solutions is normally guaranteed by the ESCO, which may or may not offer clients with direct financing for the investment.

Customers benefit from ESCO models because they reduce or eliminate performance risk and the need for internal technical expertise. They also incentivize the ESCO to supply cutting-edge products and

services while also optimizing its operations to generate large energy savings. Moreover, in the shared savings model, the customer is not required to invest and the project is financed off the balance sheet. Risks include: defaults by customers after installation; unforeseen increase in installation costs; problems with leverage for ESCOs that are overly indebted; and because higher-than-expected measurable savings translate into higher payments to the ESCO, an antagonistic relationship between the ESCO and the customer can develop.

Another model is the Energy performance contracts (EPCs), which allow cost savings to be used to fund energy efficiency projects. An EPC agreement is one in which an external organization, usually known as an ESCO, performs an energy efficiency project and uses the revenue stream from cost savings to pay for the project. The ESCO only gets paid in full if the project saves the predicted amount of energy; this shifts the project's technical risks from the client to the service provider.

V. Revolving Loan Funds

Revolving fund is any reimbursable investment instrument in which the repayments and/or proceeds of initial investments are re-invested in additional qualifying projects (Carbon Trust, 2018). Revolving loan funds are a good approach to get the government to invest in energy efficiency. Revolving loan funds begin with a set amount of cash that is loaned to end users for projects that meet a specific need, such as energy efficiency upgrades. The loan is then repaid to the fund, usually with a minor interest charge. The money that has been replenished can be revolvingly lent to new end customers. In most cases, the interest paid by end users is utilized to cover the fund's administrative costs. A government agency or a government-backed business often manages public sector focused revolving loan funds. In the United States and the United Kingdom, revolving loan funds have been successfully utilized to increase energy efficiency in public buildings such as schools, universities, hospitals, healthcare facilities, and national, state, and municipal government buildings.

The main advantage of public sector revolving loan funds is that they often have lower interest rates and longer-term tenors than commercial bank loans. In some circumstances, repayments can be matched with electricity bill savings resulting from increased efficiency, ensuring that the public entity's spending does not change much. Revolving loan funds have the disadvantage of requiring an initial pool of capital, which is sometimes restricted or difficult to come by. The initial money for many public sector revolving loan programs comes from public sources, particularly energy ministries. These resources are frequently limited, and once the first pool has been lent, no additional lending can take place until the debts have been made, which can take years. Administrative costs for revolving loan funds are frequently significant.

VI. Bulk Procurement

Bulk procurement is a no-subsidy, demand-driven mechanism that provides economies of scale enabling manufacturers to bring down their prices through successive rounds of efficient and transparent bidding to create a large and sustainable market for energy efficient products. Government authorities or the private sector issue tenders with a set of qualifying criteria to buy large numbers of energy efficient products, while suppliers compete on price bids. In each round, multiple bidders are selected and all of them are asked to match the price of the lowest bidder. The volume of the bid is then allocated to all the manufacturers who agree to match the lowest price in the bid. Aggressive bidding by manufacturers and the exclusion of regular dealers and retailers tend to drive down the price of procured energy efficient products. Bulk procurement is sometimes carried out along with maintenance services under an annual maintenance contract. Distribution agencies are contracted to distribute the energy efficient products that have been procured at a lower price to end-users, who are allowed to buy fixed amounts of units based on the payment options they elect (i.e. upfront payment, monthly instalments). The benefits of lower bulk procurement prices are passed on to end-users. Improved and economies of scale lowers prices for the targeted energy efficient products. Programmes using bulk procurement does not require subsidies, but schemes are often coupled with a product awareness campaign and innovative marketing initiatives to raise awareness among end-users who would have not acquired energy efficient products otherwise.

By aggregating the demand for a certain product on a national scale, bulk procurement has the potential to transform markets. Most importantly, bulk procurement supports the implementation of efficiency standards, and helps create sustainability in a market, passing on resulting savings to end-users.

However, the potential for product cost reduction through bulk procurement depends on the volume of tenders and the number of suppliers in an energy efficient product market. If both are small, the potential will be limited. Also, market disturbances in the market could occur and be challenging if withdrawal plans from bulk procurement are not well-prepared.

VII. Other Energy Efficiency Financing Mechanisms

The procurement of efficient transformers could be financed through carbon credits or government loan guarantee schemes. Moreover, as financing incentives are short-term solutions, they must be strongly linked with and complemented by long-term policies and regulations, as well as labelling and energy efficiency performance standards, and consumer awareness programmes. All are important supporting policy tools to change the perception and purchasing habits of customers in the long run.

The National Development Bank in Botswana has a loan facility that caters to Energy Projects for Farmers, particularly Renewable Energy Technologies. NDB and other Banks will likely have an interest in this funding efficient transformers since they understand the cash flows from efficiency.

BPC also offers a Transformer Scheme where the customer can gradually pay for the installation of a distribution transformer.

Finally, a new transformer manufacturing company setting up in Botswana may offer certain incentives or credit arrangements for procurement of efficient DTs.

4. CONCLUSION

Energy efficiency delivers numerous benefits, such as reduced operating costs, increased service quality levels, enhanced energy security and reduced air pollution, and is critical to quickly reducing global greenhouse gas emissions. However, the current rate of investments in energy efficiency is limited by barriers at the global, regional and national levels. One key barrier - the high upfront cost of efficient appliances and equipment - can be overcome through well-designed financing mechanisms, business models and risk redistribution mechanisms.

This report was based on international best practices and can be adapted and replicated for Botswana. A consultation process will be conducted with experts in the sector to determine which of the mechanisms proposed are the most suitable for Botswana.

Financing mechanisms for energy efficiency are key for mobilizing investment, but should be complemented by other efforts in an integrated approach, such as market transformation policies, regulations, awareness raising activities and. These efforts work alongside each other in a complementary manner.

A multi-faceted, integrated approach that includes policies, regulations, awareness raising activities, behavior change initiatives, labelling schemes. Compliance frameworks as well as smart financing and incentive mechanisms, guided by a national strategy is the best way to ensure long-term market transformation to energy efficient products.

Impact increases with public and private cooperation. There is a need to bring public and private actors together in partnerships, in order to achieve investments at the scale needed to meet the targets set out in the Paris Agreement and the Sustainable Development Goals. Moreover, public and private sources of finance, when used together can achieve a multiplying effect.

Financial mechanism and incentives should be designed with a long-term view. Concessional or grant finance is best used to help markets mature and unlock or encourage private investments. Grants or subsidies for example, should be designed in a “smart” way, have a clear exit plan and should aim to catalyze future growth.

Care should be taken when designing nonmarket-based financial mechanisms so as not to distort markets in an unsustainable way.

The effect of energy efficiency measures, including financing mechanisms, should be carefully analyzed from an all stakeholders perspective as they are being implemented. There is often resistance from various actors who may suffer short term loss. For example, electric utilities may sell less electricity as a result of energy efficiency measures in the short term. There are often alternative business opportunities for these

organizations that present long-term benefits and can help to garner buy in and engagement in a programme.

For energy efficiency finance mechanisms to be effective there is a need to build interest and demand for the right products from consumers. In some cases, this involves developing trust, or awareness, and removing administrative or financial barriers.

Financing mechanisms should also include financial risk mitigation instruments that reduce the risks perception for consumers and the other stakeholders involved in a project (e.g. banks, technology providers). Risk mitigation instruments can reduce risk at different levels. Risk mitigation instruments can unlock access to finance and provide better financial conditions for investors and consumers.

References

- Abed, K. A., Badr, M. A., & Shouman, E. R. (2015). *Cost Analysis of Energy Efficient Domestic Refrigerators*. 4, 12.
- Adebola, S. S. (2011). *Electricity Consumption and Economic Growth: Trivariate investigation in Botswana with Capital Formation*. 1(2), 15.
- Amusa, K., & Leshoro, T. L. A. (2013). The Relationship Between Electricity Consumption and Economic Growth in Botswana. *Corporate Ownership and Control*. <https://virtusinterpress.org/THE-RELATIONSHIP-BETWEEN,3122.html>
- APEC. (2013). *Distribution Transformer Survey: Estimate of Energy Savings Potential from Mandatory Efficiency Standards (MEPS)*. Asia Pacific Economic Cooperation.
- Asinyaka, M. (2019). Willingness to Pay for Energy Efficient Refrigerating Appliances in Accra, Ghana: A Choice Experiment Approach. *Review of Economics*, 70(1), 15–39. <https://doi.org/10.1515/roe-2018-0007>
- Atkins. (2016). *Renewable Energy and Energy Efficiency Strategy & Action Plan*.
- Baldwin, R., Cave, M., & Lodge, M. (Eds.). (2010). *The Oxford Handbook of Regulation*. Oxford University Press.
- BERA. (2021). *BERA Annual Report 2020/21* [Annual Report]. The Botswana Energy Regulatory Authority.
- BOBS. (2021). *BOBS Standards*. <http://www.bobstandards.bw/Pages/BOB-Standards.aspx?pid=0&mnusub=18&mp=0&sp=18>
- Botswana Energy Regulatory Authority Act, Pub. L. No. 13 (2016).
- Carbon Trust. (2018). *Cooling Efficiency Financing Case Studies*.
- Cardoso, R. B., Nogueira, L. A. H., & Haddad, J. (2010). Economic feasibility for acquisition of efficient refrigerators in Brazil. *Applied Energy*, 87(1), 28–37. <https://doi.org/10.1016/j.apenergy.2009.05.025>

- Danish Energy Management & Esbensen. (2017). *Renewable Energy Market Landscape Study covering 15 countries in Southern and East Africa* (Renewable Energy Market Landscape Study Volume 11). Danish Energy Management & Esbensen.
- Data Commons. (2020). *Botswana—Place Explorer—Data Commons*. https://datacommons.org/place/country/BWA?utm_medium=explore&mprop=amount&popt=EconomicActivity&cpv=activitySource%2CGrossDomesticProduction&hl=en
- de la Rue du Can, S., Leventis, G., & Shah, N. (2015). *Lessons Learned From Incentive Programs for Efficient Air Conditioners: A Review* (Research Report LBNL-191145).
- Deason, J., Leventis, G., Goldman, C. A., & Carvallo, J. P. (2017). *Energy Efficiency Program Financing* (LBNL-1005754, 1371723; p. LBNL-1005754, 1371723). <https://doi.org/10.2172/1371723>
- EBRD, & EC. (2020). *Centralised Energy Efficiency Financing Mechanisms: Policy Guidelines*. European Bank for Reconstruction and Development.
- Eil, A., Miller, A., Hillbrand, A., & Cheng, S. (2019). *Architecture & Financing Models for Efficient Cooling alongside the Montreal Protocol*.
- Essah, E. A., & Ofetotse, E. L. (2014). Energy supply, consumption and access dynamics in Botswana. *Sustainable Cities and Society*, 12, 76–84. <https://doi.org/10.1016/j.scs.2014.01.006>
- GEF, & U4E. (2017a). *Accelerating the Global Adoption of Climate-Friendly and Energy-Efficient Refrigerators* (U4E Policy Guide). United for Efficiency.
- GEF, & U4E. (2017b). *Accelerating the Global Adoption of Energy-Efficient Transformers* (U4E Policy Guide). UN Environment.
- Harutyunyan, N., & Sassi, M. (2017). *Promoting Green and Inclusive Investment in Kenya: Policies and Innovative Financing Models* (Policy Research Working Papers No. 7/01; p. 102). Cooperation and Development Network.
- Henderson, P. (2013). *On-Bill Financing Overview and Key Considerations for Program Design* (p. 7). Natural Resources Defense Council.
- How, A., & Kroes, G. (2018). *Botswana: Technical Market Review*. Climate Technology & Centre Network.

- IEA. (2019). *Botswana—Countries & Regions*. IEA. <https://www.iea.org/countries/botswana>
- IRENA. (2021). *Renewables Readiness Assessment: Botswana* (p. 94). International Renewable Energy Agency.
- Kumar, V. S., Prasad, J., Narasimhan, V. L., & Ravi, S. (2017). Application of artificial neural networks for prediction of solar radiation for Botswana. *2017 International Conference on Energy, Communication, Data Analytics and Soft Computing (ICECDS)*, 3493–3501. <https://doi.org/10.1109/ICECDS.2017.8390110>
- Kumar, V. S., Prasad, J., & Samikannu, R. (2017). Computational linear model for predicting solar energy in Botswana. *2017 International Conference on Energy, Communication, Data Analytics and Soft Computing (ICECDS)*, 2371–2386. <https://doi.org/10.1109/ICECDS.2017.8389876>
- Letschert, V., McNeil, M., Ke, J., Kalavase, P., & Sampat, M. (2014). *Energy Efficiency Potential for Distribution Transformers in the APEC Economies* (LBNL-6682E, 1163743; p. LBNL-6682E, 1163743). <https://doi.org/10.2172/1163743>
- Magallón, D., Neve, J., Pillet, A., Motmans, T., Morais, L. M., & Lemoine, P. (2019). *Manual of Financing Mechanisms and Business Model*. Basel Agency for Sustainable Energy for UN Environment.
- Markandya, A., Labandeira, X., & Ramos, A. (2015). Policy Instruments to Foster Energy Efficiency. In *Green Energy and Efficiency: An Economic Perspective* (p. 23). Springer.
- Maswabi, M. G., Chun, J., & Chung, S.-Y. (2021). Barriers to energy transition: A case of Botswana. *Energy Policy*, 158, 112514. <https://doi.org/10.1016/j.enpol.2021.112514>
- Maswabi, M. G., & Kim, K. N. (2018). An Overview of the Development of Botswana's Renewable Energy Policy Framework. *Bulletin of the Korea Photovoltaic Society*, 4(1).
- Ministry of Mineral Resources, Green Technology and Energy Security. (2021). *National Energy Policy* [Policy Instrument]. Ministry of Mineral Resources, Green Technology and Energy Security.
- Mooiman, M., Matlotse, E., & Molefhi, B. (2016, October 26). *A Review of Energy Efficiency Initiatives in Botswana*.

- Mukwaso, S. T. (2017). *Botswana electricity sector planning and CO₂ emissions reduction through solar PV in office buildings* [Thesis, The University of Waikato]. <https://researchcommons.waikato.ac.nz/handle/10289/12112>
- Munene, M. B., Odongo, J. O., & Nyambane, A. (2019). *Public Awareness, Strategies, Challenges and Opportunities* (p. 44). Heinrich-Böll-Stiftung.
- REN21. (2015). *SADC Renewable Energy and Energy Efficiency Status Report*. REN21.
- SE4ALL. (2012). *Botswana: Rapid Assessment and Gap Analysis*. Sustainable Energy for All.
- State and Local Energy Efficiency Action Network. (2014). *Energy Efficiency Financing Program Implementation Primer* (DOE/EE-1020, 1220861). Lawrence Berkeley National Laboratory. <https://doi.org/10.2172/1220861>
- Sustainable Energy for All. (2012). *Sustainable Energy for All: A Global Action Agenda* (p. 32). Sustainable Energy for All.
- Sustainable Energy for All. (2020). *Botswana: Rapid Assessment and Gap Analysis*. Sustainable Energy for All.
- The International Renewable Energy Agency. (2021). *Renewables Readiness Assessment: Botswana*. The International Renewable Energy Agency.
- The World Bank. (2019). *Population, total—Botswana | Data*. <https://data.worldbank.org/indicator/SP.POP.TOTL?locations=BW>
- Thollander, P., & Palm, J. (2013). Policies Promoting Improved Energy Efficiency. In P. Thollander & J. Palm (Eds.), *Improving Energy Efficiency in Industrial Energy Systems: An Interdisciplinary Perspective on Barriers, Energy Audits, Energy Management, Policies, and Programs* (pp. 105–134). Springer. https://doi.org/10.1007/978-1-4471-4162-4_7
- UNIDO. (2017). *Overview of Renewable Energy and Energy Efficiency* [Training Package]. The United Nations Industrial Development Organization.
- V., S. K., Prasad, J., & Samikannu, R. (2018). Barriers to implementation of smart grids and virtual power plant in sub-saharan region—Focus Botswana. *Energy Reports*, 4, 119–128. <https://doi.org/10.1016/j.egy.2018.02.001>

- Venkatachary, S. K., Prasad, J., & Samikannu, R. (2017). Cost Optimization of Micro grids Using Homer: A Case Study in Botswana. *International Journal of Energy Economics and Policy*, 7(5), 323–339.
- Xavier, Y. M. de A., Guimarães, P. B. V., & Silva, R. K. C. da. (2020). *Energy Efficiency in Developing Countries* (1st ed.). Routledge.