Financing Mechanisms Report

Financing Mechanisms Report - Eswatini

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U4E United for Efficiency

GREEN CLIMATE FUND

CTCN UN Climate Technology Centre & Network
UNFCCC Technology Mechanism

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CHANGING LIVES CHANGING WORLDS

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS

AfDB	African Development Bank
DoE	Department of Energy
EEC	Eswatini Electricity Company
EU	European Union
GCF	Green Climate Fund
GWP	Global Warming Potential
HEPS	Higher Energy Performance Standard
IPP	Independent Power Producer
IMF	International Monetary Fund
LED	Light emitting diode
MDG	Millennium Development Goals
MEPS	Minimum Energy Performance Standard
MNRE	Ministry of Natural Resources and Energy
ODS	Ozone Depleting Substances
PWG	Policy Working Group
SADC	Southern African Development Community
SZL	Eswatini Lilangeni
TBD	To Be Determined
TCO	Total Cost of Ownership
UA	Units of Account
U4E	United for Efficiency

1 Introduction

The 'Leapfrogging to Energy Efficient Appliances and Equipment in Eswatini (Refrigerators and Distribution Transformers)' project is funded by the Green Climate Fund (GCF) and being implemented under the guidance of the government of the Kingdom of Eswatini (Eswatini). The project is also being implemented simultaneously within 7 other countries of the Southern African Development Community (SADC) region, namely Botswana, Zimbabwe, Namibia, Malawi, Lesotho, Zambia and Tanzania. Eswatini has no independent access to the coast/sea. Therefore, it is heavily reliant on use of South African ports for the import of essential commodities, including electricity, which is purchased from Eskom, the state-owned utility in South Africa. The electrification rate in Eswatini is currently around 84% with universal access to electricity projected by the end of 2022 [1] The government of Eswatini has embarked on a drive to improve its electricity generation capacity to diminish its dependence on imported power from South Africa and to provide greater security of supply. A National Energy Policy was developed in 2018 to facilitate this process. An Independent Power Producer (IPP) Policy was established under the Ministry of Natural Resources and Energy (MNRE) to increase the utilisation of solar and biomass generation plants. The Lavumisa 10 MW solar plant project is nearing completion while there are 40 MW solar and 40 MW biomass generation plants planned for construction in 2021 [1]. The expansion of the grid will result in an increase of transformers on the network. Any improvement in the technical losses present on distribution transformers will have an immediate impact on energy efficiency improvements for the entire network and has direct cost savings for the country. Refrigeration appliances, in particular household refrigerators are also a major contributor to technical electrical losses. Refrigeration appliances are always operating and therefore consume electrical energy constantly. Therefore, energy efficiency improvements in these appliances have a continuous impact on energy efficiency improvements for the country.

The project focused the development of national standards related to energy efficiency of distribution transformers and household refrigeration appliances and a framework for implementation that will improve the energy efficiency of these appliances. In addition to the national standard the Minimum Energy Performance Standards (MEPS) and Higher Energy Performance Standards (HEPS) an energy labelling scheme for refrigerators has been developed. The project engaged with all of the key stakeholders within the country to create a system through which the necessary legislation can be developed related to the implementation of the MEPS and also to create a national implementation plan that will both enable the implementation of the MEPS but also create a framework within Eswatini for future development of related standards and legislation. The project also delivered the total cost of ownership (TCO) tool related to distribution transformers to Eswatini and trained their main purchasers of distribution transformers on the TCO tool and how to implement it. In order for the tools mentioned above to be utilised and for the effects in relation to improved energy efficiency to be realised there is an understanding that there is a higher initial cost of purchase of more energy efficient commodities. Therefore, financing mechanisms that can be pursued to support the purchases and the higher

initial costs have been investigated. This report outlines the recommendations for financing mechanisms for refrigerators and distribution transformers in Eswatini.

2 Background

Based on the market assessment there are several key aspects that need to be considered as related to the financing mechanisms for refrigerators and distribution transformers, which will assist in making the implementation possible. These two commodities are vastly different, have different purchasers and thus require completely different approaches to financial supporting mechanisms.

The consumers of refrigerators are the general public. In order for them to participate in the drive for higher energy efficient refrigerators the higher initial cost of the products must be acknowledged and considered within the Eswatini environment. For this reason, there are several aspects of the market assessment that provide key insight into the type of financial support required and also the type of consumer patterns that are existing in Eswatini at the moment.

In order to ascertain which financial supporting mechanisms are most important it is key to understand certain aspects of the Eswatini consumer. Some of these are:

- Disposable income
- Cost of electricity and monthly spend on electricity
- Cost of refrigerators most commonly sold in Eswatini
- Cost difference between refrigerators of similar volume and functionality but differing energy efficiencies
- Number of refrigerators sold per year in Eswatini
- Average age of refrigerators currently in usage in Eswatini

From this information one can understand approximately how many refrigerators are expected to be sold in Eswatini each year. Also, one can understand how much households can save per month on electricity by purchasing more efficient refrigerators. Additionally, one can understand the price difference between similar refrigerators with differing efficiency levels. This information will provide the amount of financial support required and the type of support that would be most effective to implement. This information was gathered during the market assessment phase of the project. Eswatini has a population of approximately 1.2 million and an average household size of 5.84. This results in approximately 205 000 households. With the electrification rate of 84% this means a total of approximately 173 000 households that are electrified. Eswatini has a high electrification figure and this is growing. In parallel the number of persons per household is decreasing from 9.52 in 1997 to the current figure below 6. This means that there will be more households with access to electricity in the near future. With increased electrification there is an increase in the number of electrically powered appliances that are purchased and utilised. One of the first electrical appliances purchased by newly electrified residents is a refrigerator. The U4E estimate is that by 2030 Eswatini will have approximately 240 000 refrigerators [2]

Currently the refrigerator market is approximately 35 000 units per annum sold. This figure is likely to grow. From the market assessment it was also found that approximately 92% of the refrigerators purchased are new [3]. Therefore, there are going to be significant purchases of refrigerators in the next 2-3 years in Eswatini, of approximately 32 000 units per year. The average disposable income in Eswatini is in the region of $100 - $200 per month. The average electricity spend is in the region of $20. If one considers other expenses such as rent, groceries, etc. the cost of electricity is a considerable amount of disposable income. Since the disposable income in Eswatini is not large spending more on energy efficient appliances is not an easy decision to make even if there are cost savings to be made during the lifetime of the appliance.

In relation to distribution transformers it is important to understand the overall electrification of the country and the projections for future electrification are known as all of the electricity of the country passes through transformers at some stage of its journey. At present, power generation and the transmission and distribution of electricity to the general population of Eswatini is the responsibility of the Eswatini Electricity Company (EEC), a state-owned power utility. According to the ESERA annual report from 2020 the country's peak demand was 245 MW and the energy supplies to customers was approximately 1,580 GWh. The customers were predominantly industry (50%) and domestic (36%). The EEC can provide 60.4 MW of power to the grid via the operation of four hydro power plants. However, the hydropower plants contribute only around 17 percent of the total energy required in Eswatini. The remaining power is purchased from Eskom in South Africa and on rare occasions from Electicidade de Mocambique (EDM) [3].

In addition to the 60.4 MW hydropower plants operated by the EEC, there is 110 MW of independently produced power within Eswatini. Ubombo Sugar Mill produces 41 MW of biomass generated power, 13 MW of which is made available to the grid. The Royal Eswatini Sugar Corporation also produces 65.5 MW of power via biomass generation, while USA Distillers and Wundersight produce a combined 2.3 MW of power from coal and solar generation respectively [4]. The EEC also owns 9 MW of diesel generation but the plants at Edwaleni Power Station have been mothballed due to their high operational costs, that renders their function economically unviable.

From the developments mentioned above it is evident that electricity supply and demand will continue to grow and that a number of new transformers will be installed on the network in Eswatini. In terms of distribution transformers the requirements are vastly different from refrigerators. It is more costly to manufacture energy efficient transformers than transformers with higher losses. The higher costs may be as a result of one or more of the following parameters:

- Using lower loss core steel,
- Using lower loss conductors,
- Employing more stringent manufacturing techniques,
- Using improved manufacturing equipment, and
- Employing low loss transformer design techniques.

Lower loss transformers are larger and heavier than their less efficient counterparts and require larger tanks and more oil which contributes to the higher initial cost of more efficient transformers. The purchasers of distribution transformers are predominantly the EEC and to a lesser extent Ubombo Sugar and Royal Swazi Sugar Corporation as well as some other smaller buyers. The purchases are therefore done by large organisations and are predominantly bought in bulk (usually through tender processes). The procurement of transformers therefore requires significant financial reserves and guarantees. The EEC obtains it's funding from the Ministry Natural Resources and Energy, which in turn applies for funding from the government of Eswatini. The funds are generally made available via loans obtained from lending institutions such as the World Bank and the International Monetary Fund (IMF).

3 Benefits of Energy Efficient Appliances

Having introduced the background to the project and the financial mechanisms required to support its implementation in the previous sections it is also poignant to outline the general importance of energy efficiency projects, specifically from an economic perspective. Cost-effective energy efficiency improvements can have positive macroeconomic impacts, boosting economic activity and often leading to increased employment. Energy efficiency reduces the amount of energy needed to deliver services, such as transport, lighting, heating and cooling. Lowering the cost of energy and the associated services frees up resources for households, businesses and governments. Therefore, the impacts of energy efficiency can bring a multitude of benefits to the country and can drive economic growth, increase employment and reduce energy prices [5].

As mentioned above energy efficiency can have a positive impact on job creation. For example, in Europe, a study assessing the impact of the EU's Ecodesign Directive projects, found that the efficiency measures developed as part of the directive will lead to 0.8 million additional jobs by 2022 [5]. Furthermore, the continuous drive towards energy efficiency requires more innovative thinking on the part of energy companies and utilities. As such this leads to job creation in this sector for a multitude of disciplines from engineering to marketing, finance and science [5]. Energy efficiency also leads to a better working environment and hence better productivity. It has been found that employee productivity is affected by the physical work environment – temperature, air quality, and lighting [6]. Introducing energy efficiency into the work environment and into the country as a whole can have an impact on all of the above. More efficiency means less generation is required for the same output and hence the reduction of greenhouse gases and lower of global warming and improved air quality due to a reduction of emissions.

Having outlined the positive economic impacts it is important to note that the majority of the world’s energy demand growth is projected to occur in the low and medium income countries, such as Eswatini [6]. The growth in energy demand can also have the obvious negative impacts on the environment and various sustainable development goals that have been set globally and within such countries [6]. Effective investments into energy efficiency can support the transition towards higher energy demand and usage in a more sustainable manner. Apart from only the obvious energy savings and associated financial savings there are other aspects that investing into energy efficient projects can provide. These include the greater access to electrical energy within the country, the increase in productivity that electrified machinery provides to manufacturers, the ability for upward mobility of the population through access to the internet and the education and entrepreneurial possibilities that it brings.

4 Barriers to Energy Efficiency

Energy efficiency methods and policies have been recognized internationally as one of the key areas that can bring positive impacts in the overall sustainability goals. However, the implementation of such policies and projects remains a challenge, in particular in relation to obtaining funding, specifically in developing countries [7]. This is particularly related to the cost of initial purchase of energy efficient appliances once the policies are implemented. Without the public buy-in, the policies often remain only applicable in paper and are not implemented on the ground/in practice. This can lead to the public's reluctance to follow future regulation or policies related to other energy efficient appliances. The conversion of potential savings often faces numerous barriers and some unforeseen costs, including transactional costs for funding [7]. Typically, the technology related to energy efficiency requirements is available or becomes available at a relatively rapid rate. However, often it is institutional and bureaucratic issues that become the stumbling blocks to implementation and funding approval. However, it is possible to learn from projects being implemented around the world and the mistakes made in some of them and lessons learnt [7].

It is also worth noting that the majority of the focus has been technological improvements that aid increased efficiency. The interest from the financial sector has been relatively low. Often the challenge is the scale of the projects. The problem is that the project owners that are interested in pursuing energy efficiency often do not have the up-front funding required and since their project often focuses on a single energy efficiency measure the scale is too low to attract financing from larger institutions. The deal origination and the transaction costs of funding single projects often outweighs the financial impact that would be achieved with energy efficiency in such a project [8]. Having provided the background to some of the general financing challenges some of the main barriers experienced during implementation of energy efficiency projects are:

- **High initial cost of purchase or installation**

The increase in energy efficiency in most refrigerators comes through the use of better materials and through the use of more insulation. These improvements increase energy efficiency and also in most cases increase the quality of the refrigerator. The increase in quality however comes with an increase in cost and hence an increase in the initial selling price. This ultimately means that a refrigerator that is more energy efficient than another model of the same size/volume and with the same features, will be more expensive. This increase in the initial selling price of the refrigerator is usually offset by the electricity savings that are made during the lifetime of the refrigerator due to its lower energy consumption. However, the extra capital required for the initial purchase can be a restricting factor for families to participate in the increase energy efficiency drive. This can be especially difficult for lower and middle class income families. The median income of an Eswatini family falls in the lower to middle class category. Therefore, for such income households, paying a higher initial cost for an energy efficient refrigerator may not be feasible.

- **Lack of access to finance/financial support**

As mentioned, the majority of households in Eswatini would be vary of spending more money than necessary on the initial, higher cost of more energy efficient refrigerators. Therefore, this is a critical aspect of the project, as many willing buyers and effective participants in the energy efficiency drive could be turned away due to the lack of access to funds.

- **Energy prices**

At times the energy prices in countries are extremely low. This was the case in South Africa in the past, specifically in the 1980s and 1990s. This was due to the strategic decision by the government of the time to drive economic growth through cheap, bulk power to assist in powering electricity heavy industries such as mining and aluminium smelting, etc. It is also the case for example in Kazakhstan, which benefits from the nuclear power installed during the Soviet era, that remained within its control after the breakup of the Soviet Union. Therefore, the initial cost of establishment was shared but the current benefit is for Kazakhstan, enabling low electricity prices (until the maintenance on the ageing plants becomes increasingly expensive). In situations such as these the low cost of electrical energy can be a detrimental factor as the financial savings are minimised. Therefore, the impact of improved energy efficiency on the consumer spending is also minimised and as such the incentive to purchase more energy efficient refrigerators at a greater initial cost is diminished.

Eswatini also benefited from cheap electricity supply from South Africa. However, this landscape has drastically changed. South Africa has been experiencing a declining electrical utility without the ability to maintain its ageing infrastructure (generation plants and distribution network in particular). This has resulted in increases in electricity prices and a substantial reduction in availability of electrical energy. The impact has been felt by Eswatini. The electricity prices of imports from South Africa have increased and the reliability of supply has decreased. South Africa has experienced what has been termed as load shedding, which means the switching off of electrical supply to customers for a certain period (e.g. 4 hours or 2.5 hours) in a rolling blackout manner. Eswatini has so far had limited electricity shortages but its contract with Eskom is due to expire in 2025 and with that change the load shedding will be implemented in Eswatini and electricity shortages will become a reality.

- **Lack of awareness of benefits of Energy Efficiency**

As there have been no previous campaigns related to energy efficiency of refrigerators aimed at the public in Eswatini, the general consumer is unaware of the benefits (financial or otherwise) of energy efficiency. The limited exposure that there has been to energy efficiency is through the South African label seen on most

refrigerators in stores. The public is however unaware of the financial and environmental benefits of improved energy efficiency. As such a targeted and well-presented consumer awareness campaign can be a substantial asset to this project and is in fact one of the key implementation elements. The price differences between old refrigerators and ones with improved energy efficiency have been reducing. Thus if the public can be aware of the financial savings it can make on their monthly electricity bills, far more people will opt for more efficient refrigerators, as the savings over the lifetime of the product are substantial.

5 Financing Mechanisms

Given the general challenges to the purchasing of energy efficient appliances, outlined in the previous section, possible financing mechanisms that are applicable to refrigerator and distribution transformer purchasing are outlined below. These financing mechanisms were discussed at numerous meetings of the PWG and during the national stakeholder workshops held in October 2022. The general description of the various financial mechanisms and the advantages and disadvantages of each have been described in more detail below. It is important to note that certain financing mechanisms discussed below are only applicable to refrigerators and some are only applicable to distribution transformers. This is because the consumers/buyers of refrigerators and distribution transformers are vastly different and the costs are also very different.

Grants

Grants are financial support mechanisms through which funds are provided to organisations or individuals for a specific purpose and where no payback is required. Therefore, the funding is typically applied for and is related to an area that is supported by the donor. Grants are usually given by governments and are aimed at specific industries or for driving certain economic development within a country. In this case it could be the drive towards increased energy efficiency, which will be beneficial for the country, reduce reliance on electricity imports, etc. Therefore, the government supplies the funding for the greater goal of the entire country. It could also be as part of the drive towards industrialization as the government may provide grants to companies qualifying to set up factories and hence boost manufacturing in a specific environment (e.g. automotive/car manufacturing). This type of financing mechanism is only realistically relevant to the purchases of distribution transformers. The government or a particular ministry with adequate funding would typically provide a grant to an organisation (whether it be a state owned or private utility or large industry/purchaser of distribution transformers) to purchase more efficient distribution transformers as an investment that benefits the country in the long term.

Advantages

Some of the advantages of grants are that they are usually provided by one organisation (a governmental department) and as such the process of application is relatively simple and transparent. They are therefore, in theory, easy to set up. The access should therefore be clear and relatively easy if the funding is pre-approved.

Disadvantages

As indicated grants are usually provided for by government and governmental institutions. They therefore often require long lead times to materialize, depending on governmental efficiency. Furthermore, and most importantly, there is no payback on the loan. They therefore encourage overspending. Since the receiver of the grant understands that they do not need to repay the money there is no incentive to drive down unnecessary costs. The funding of $2 million that is budgeted is then often inflated on unnecessary expenses and often

doubles. It is therefore not always the most efficient method of implementation. Furthermore, funding at governmental level needs to be available for such projects.

Direct Loans – Green funding

Direct loans are typically provided for by agencies or organisations that are specifically geared for funding in a certain industry or area. In this case it would be green energy/energy efficiency. As these institutions are set up for a specific purpose they are usually able to provide good interest rates on the loans. Direct loans are typically provided for larger scale funding due to the administrative costs of the setup of the loan. Therefore, this type of financing mechanisms is more suited to the funding of the purchase of distribution transformers.

Advantages

Direct loans are usually set up for a specific purpose. As such they are generally set up through a governmental mechanism of support or through other international backing or re-insurance, etc. Therefore, they often have a preferential interest rate on loans for the specific purpose. For example, since the requirement in this project is for energy efficiency implementation funding there could be organisations that are set up for loans for such a purpose (like the Green Climate Fund, Green Energy fund or the World Bank green energy funding mechanisms). These institutions are either part of a global initiative towards green energy or as a private organisation providing such funding these loans are at times offset against tax or carbon credits, etc.

Disadvantages

The direct loans can be difficult to set up as they often require substantial documentation and require a longer process to implement. They are thus difficult to set up in the timelines provided in this project if they are a part of the stand-alone loan requirement. However, in this project the preliminary work on the standard and the energy label has already been conducted. As such there is a possibility of getting an extension of a loan on the implementation aspect of the same energy efficiency project.

Tax rebates

Tax rebates and tax benefits are mechanisms whereby the organisation that provides the loans or funding is able to receive certain tax benefits for this. For example, a company may spend money on investing in energy efficient equipment. If this is pre-agreed with the revenue authority that company can get tax offsets for this spend or it can get tax benefits in terms of accelerated depreciation of the equipment purchased and thus a greater reduction in tax spend.

Advantages

One of the main advantages of tax rebates or tax benefits is that it drives similar behaviour within the organisation. For example if a company received accelerated depreciation benefits for purchasing more efficient

refrigerators or transformers it can then see the direct benefit of energy efficiency. As such in the next possible instance it may seek the same benefit (for example changing all of its lighting in its offices into more efficient/LED lighting).

Disadvantages

The main disadvantage, apart from requiring buy in from the tax authority, is that the consumer or the beneficiary requires a large tax base from which to offset such a benefit. It is therefore not really suitable to individual persons but rather to substantially sized organisations.

Financial Guarantees

These are typically guarantees that a government provides to organisations or rather to suppliers to the organisations that guarantee that the loan will be repaid. The guarantees can also be provided by international funding institutions and utilities. In the African context however, the majority of the guarantees are provided by government. They are usually termed government guarantees. They are usually supplied by the governments for large projects as a backing of the loan. In certain instances where the governmental balance sheet is not adequate and the financial status of the country is unstable these guarantees are backed by raw materials, minerals, etc. For example if the DoE wants to take out a loan to implement the project from a financial institution and a governmental financial guarantee is provided for the loan there is more likelihood of the loan being approved and at better rates because the repayment risk is reduced.

Advantages

The main advantage is that the risk is split and carried by a large backer, such as the government, and thus there is leverage over the risk

Disadvantages

The main disadvantage is that the guarantor for such a project is usually very large and that the process of obtaining such a guarantee can take a substantial amount of time.

Bank Loans

These are typically standard bank loans that are available to most persons owning a bank account and qualifying for a loan. The pre-requirements for a loan are typically not high but the loan amount can be limited. These are not loans that are specific to energy efficient technology and are standard bank loans.

Advantages

The biggest advantage of bank loans is that they are easily accessible. In order to qualify people generally just need a bank account and to have certain funds or a certain track record of loan repayment.

Disadvantages

One of the disadvantages of bank loans is that they are not designed for energy efficient projects. They are therefore standard loans and the interest rates are typically high. Also, persons without a bank account are unable to qualify for the loan and the loan amount is generally small – thus limiting the impact of such loans.

On-Bill Financing

On-bill financing is a support mechanism whereby an initial amount is provided to the consumers for the purchase of the energy efficient refrigerator by the electrical utility/electricity service provider. The consumer then repays the loan through the pre-defined monthly repayment through the electricity bill. The additional amount is added to the monthly electricity bill effectively. This type of financing mechanism is suited for the purchase of refrigerators as it is geared for the general consumer rather than large organisations, which typically purchase distribution transformers.

Advantages

The main advantage is that this is a very efficient way to reach the refrigerator buying public. The repayment can be controlled through the electricity bill and most importantly consumers can see the benefit of energy efficient appliances directly. For example, if they usually spent SZL 300 on electricity and they bought a new refrigerator (that is more efficient than their previous one) for which they took out a loan of SZL500, and for which they need to repay SZL50 per month for 12 months, they would expect to pay SZL300 + SZL50 = SZL350 per month. But with the more efficient refrigerator their monthly saving may be SZL20 and hence the electricity bill may be SZL330, a saving which they can directly see.

Disadvantages

The main disadvantage is that the risk in this type of financing is carried by the consumer. The electricity company can simply switch off the electricity supply if the loan is not repaid and they can impose penalties on the electricity bill thereafter (e.g. for re-connection).

On-wage Financing

On-wage financing is similar to on-bill financing, except the loan amount is provided by specific employers of the consumer. Therefore, an employee would go through qualifying criteria within its place of employment. The employer would then approve the employee for a loan related to the purchase of energy efficient appliances. In this case this type of financing is suited to the purchase of refrigerators. The employee would thus receive financial support, perhaps in the form of a voucher, which could be redeemed at the time of purchase of an energy efficient appliance (refrigerator). The value of the loan (voucher) would then need to be repaid by the employee to the employer as per the agreement. This would usually be deducted from the monthly salary of the

employee for several months until the loan is repaid. Interest could be charged on the loan by the employer and this would be decided at the loan stage through agreement of terms with the employee.

Advantages

The advantage is that this type of finance is typically relatively easily accessible to most. If the employer has a loan for the financing then the risk is also shared between the employer, consumer and financial loan provider.

Disadvantages

The main disadvantage is that this type of finance is not available to the non-employed. Additionally, some employers are not ready to take on such a risk without added benefits.

Bulk procurement

Bulk procurement is the procurement of goods and/or services to a large monetary value. Various countries define the value threshold differently but typically it is in the region of over $100 000. Therefore, purchases above that made in one transaction or in one contract are considered bulk procurement. When large value items are purchased by one buyer there is the possibility of using bulk procurement for reducing the costs. This would particularly be useful for purchasers of distribution transformers. The increased initial capital investment required for purchasing more efficient (less lossy) distribution transformers can be offset by obtaining discounts for bulk procurement by a utility. If buying through total cost of ownership is done throughout the specific utility then a larger contract can be implemented based on that same criteria for the entire utility and transformers purchased in bulk rather than through many smaller contracts (in each region of the country for example).

Advantages

The advantage of bulk procurement is that often the buyer is able to obtain a better price per item when procuring in bulk. This is because the cost of production per item is often reduced when manufacturing in bulk (as one setup is required per production run). Additionally, the cost of transport, packaging, etc. is reduced per item.

Disadvantages

The main disadvantage is projecting the volumes of product needed as bulk purchasing often leads to overbuying. In such a scenario the cost of storage can become a burden. With good projections and planning this can however be overcome.

6 Financing Mechanisms suited to Eswatini

This section outlines the details related to some of the financing mechanisms that are most suited to the Eswatini project. Due to the difference in the financial mechanisms appropriate for the two parts of the project the section has been split into refrigerators and distribution transformers.

6.1 REFRIGERATORS

In order for the project to be successful it requires the purchase of more energy efficient commodities, which come at a higher initial cost. This cost needs to be accounted for. Therefore there is a requirement for financial supporting mechanisms to assist consumers to purchase more energy efficient refrigerators.

The financial mechanisms below are the ones that are most likely to be implemented within Eswatini based on the discussions during the financial mechanisms workshop and the PWG meetings. These include:

- On-bill financing
- On-wage financing
- Tax benefits

There is also an option of combining some of the mechanisms listed above. The one option discussed was the combination of on-wage financing and the tax benefits for those companies that choose to participate in the programme.

Before understanding the best mechanisms to implement it is important to understand the amount of funding required for these purchases. As mentioned previously the household refrigerator market is approximately 35 000 refrigerators per annum [3]. Additionally, 57% of refrigerators in Eswatini are 7 years or older as shown in Figure 1 below.

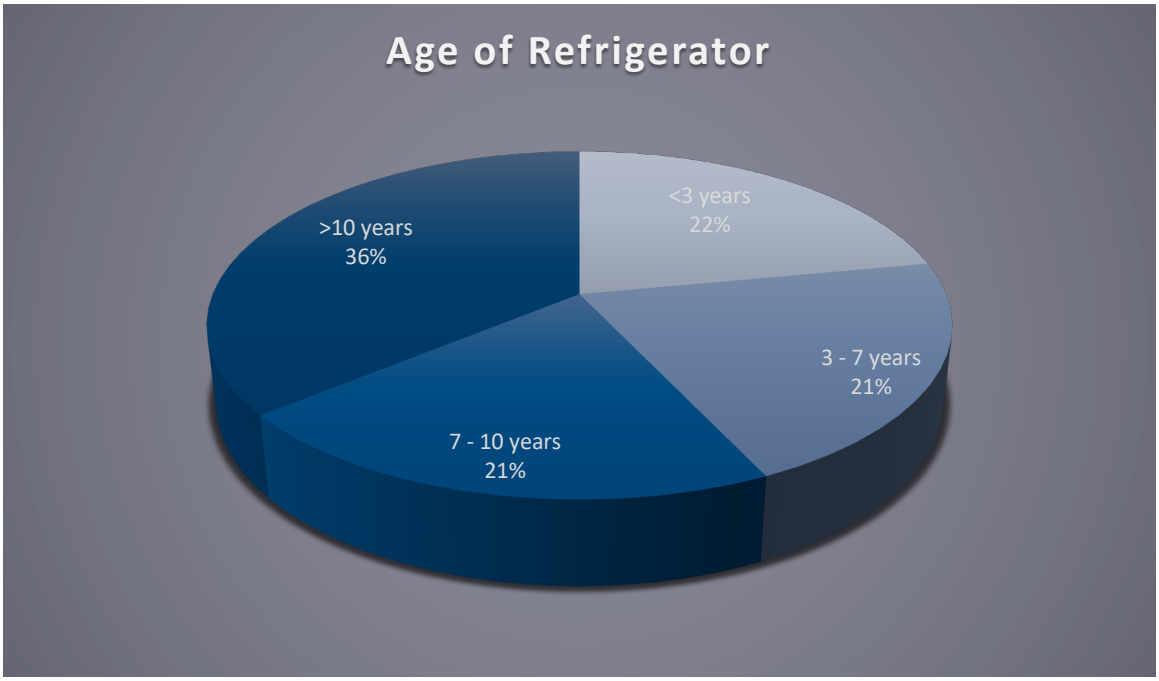

Figure 1. Age of refrigerators gathered from the surveys

Generally refrigerators are replaced after 10-12 years. Eswatini's population is also approximately 1.2 million. The electrification rate in Eswatini is approximately 84% [3]. Therefore, 84% of the 1.2 million people have access to electricity and thus may have refrigerators. The assumption is made that all of those that have access to electricity would have a refrigerator. This is a fair assumption since refrigerators are one of the main and first appliances bought by persons with access to electricity. Based on these assumptions it would mean that approximately 1 000 000 people in Eswatini live in a household with a refrigerator. The average household in Eswatini is 5.8 persons. Also there is on average 1 refrigerator per household. Therefore, from the figures above, there are approximately 174 000 refrigerators in the country. Of those approximately 50% are likely to be replaced in the next few years. This is a figure of approximately 87 000 refrigerators that are likely to be replaced in Eswatini in the next 3 years. Dividing 87 000 by the 3 years we have a number of 29 000 refrigerators. Additionally, 90% of respondent in the market assessment surveys indicated that they would purchase new refrigerators. Therefore, 90% of 29 000 equals 26 100 refrigerators that will probably be replaced in Eswatini in the next year. The refrigerator market is 35 000 refrigerators per year. This correlation of 35 000 and 26 100 is relatively close if one considers the estimates made to get to the 26 100 number and the fact that importers will often order more refrigerators per year than are sold in order to have additional stock on the shop floors.

If the MEPS are implemented that means that the majority of refrigerators are going to be purchased at a level D (as per the Eswatini National Standard with the R value between 1 and 1.25 from analysis of prices both in Lesotho and in Eswatini and in discussions with the Palfridge the increase in price per increase in energy efficiency level (as per the South African energy label and although it is not an exact correlation with the different standards) is approximately 8% - 10%. This is a comparison of (as closely as possible) 2 refrigerators that have the same volume are from the same manufacturer and have the same functionality but the one is more efficient that the other model by one energy level (one HEPS level).Therefore, if the aim of the project in year one is to

encourage the majority of persons to purchase a refrigerator of level C and above then the difference in price is 10%. The average price of a common fridge/freezer combo in Eswatini is between 5000 and 7000. Therefore, it is safe to assume that the difference in price is 6%.

Also it is important to note that the persons that are going to be buying a refrigerator next year would be buying one if there was the new standard or not as per the calculations above. They therefore have funds to purchase a new refrigerator in most cases. If we assume that the MEPS are implemented and the lowest class available is D and that all of the buyers would want to purchase a level D refrigerator then we need to consider subsidizing the initial difference of purchase to a level C refrigerator. Therefore, the amount of funding required for this transition is as per the calculation below.

30 000 (estimate of new refrigerators purchased next year) x 600 (cost difference from D to C energy class) = SZL18 000 000. This equates to approximately $1 100 000.

Of course consumers would be encouraged to purchase refrigerators in higher classes also and can get a double subsidy (e.g. SZL1 200 to purchase a refrigerator in class B, instead of C, but the above is used to calculate the minimum support required in order to understand feasibility). Therefore, one then needs to consider the financing mechanisms in this context of approximately $1.1 million offending required for the first year of implementation. It must be noted that this would be in the form of loans and not funding that is in the form of a grant. This is the lowest level of financing support required. If consumers wish to purchase refrigerators that are level B or level A they would need additional support. The same principle would apply as the cost of initial purchase would just increase by SZL1 200 or SZL1 800. The consumers would still be able to apply for financing for the greater amount that they require to purchase the more efficient refrigerator. For simplicity of calculation the case of purchase of refrigerators with one level higher energy efficiency is used.

Thus, the **on-bill financing** would work as follows:

- A potential purchaser of the refrigerator would apply for a voucher of SZL600 for the purchase of a new refrigerator with the EEC
- The EEC would have a pre-determined set of qualifying shops where the voucher can be used. The voucher can only be used for purchases of refrigerators that are level C and above as per the energy label
- The successful applicant would purchase the new refrigerator and use the voucher.
- The EEC would be notified of that customers name, surname and ID number
- The EEC would then add the amount of SZL600 to the electricity bill (split on a pre-determined number of months, e.g. SZL60 per month for 10 months or 12 months if the EEC decides to charge interest)

In order for the above to be implemented there are several aspects that need to be considered, specifically related to lending risk. In order to mitigate the risk to the utility certain pre-qualifying criteria of lenders need to be applied. These can often be linked to criteria that the general banks in Eswatini apply. The banking sector

in Eswatini is well established and is comprised of large South African based banks and some local banks. The criterial qualifying the public consumers for a loan could then be used in order to qualify for a loan/voucher related to on-bill financing of refrigerators.

From the discussions during the PWG meetings and workshops, it was indicated that the EEC is unlikely to be able to support on-bill financing at this stage. They have invested into the electrification programme, which has been successful and capital is not readily available for such a project. However, on-bill financing is something that should not be discarded in Eswatini. There is a possibility that the EEC does have funding available in the near future or that another institution is willing to fund such a programme through the use of the EEC's billing mechanisms. The payment of the loan through the electricity bill is very easily set up and is easily implemented/recovered. As such it remains a very attractive mechanism. One possibility is for a loan to be taken by the EEC for the issuing of individual loans to consumers. This overall loan taken by the EEC would originate from one of the international green funding mechanism or from one of the national financial institutions. Governmental guarantees can be issued for this loan and hence the EEC would have a smaller interest rate on the bulk loan than it can charge on individual loans to consumers. This is required as the EEC needs to take into account a certain percentage of loan defaults. The loan amount can also be offset by allowing consumers to bring in their old refrigerators. These refrigerators could then be recycled and the consumer could receive the recycling value in terms of a voucher to contribute to the purchase of a new, efficient refrigerator.

However, the on-wage financing was further discussed, given the value of funding required. It was noted that the majority of persons purchasing a refrigerator are employed. Additionally, it may be easier to break the problem into smaller portions (in terms of the organisations issuing the loans) and obtain funding in this manner.

As such the process of on-wage financing would be very similar:

- A potential purchaser of the refrigerator would apply for a voucher of SZL600 for the purchase of a new refrigerator with their employer
- The employer would have a pre-determined set of qualifying shops where the voucher can be used. The voucher can only be used for purchases of refrigerators that are level C and above as per the energy label
- The successful applicant would purchase the new refrigerator and use the voucher.
- The employer would be notified of that customers name, surname and ID number
- The employer would then add the amount of SZL600 to the salary deductions (split on a pre-determined number of months, e.g. SZL60 deduction per month for 10 months or 12 months if the employer decides to charge interest)

There is an additional possibility of adding support to the lenders, which will further enable the implementation of this scheme. In order for the employers to benefit they could have a tax benefit offset for the amount that they have subsidized to their employees. This could therefore be very lucrative for the employers and could offset

some of the risk that they would have on employees who would leave their employ prior to the finalisation of the payback of the loan. This possibility was discussed with the ERS during the final PWG meetings. The ERS has indicated that they do currently have tax benefit schemes in place. There is a mechanisms which has therefore already been established. However, the possibility of implementing this will be decided during the implementation meetings that will continue in 2023 amongst the Eswatini implementation PWG (task team). An example of this scheme would be as follows: the employer would provide loans for its employees. In order to qualify for the loan the employees would need to fulfil several criteria. The criteria could be similar to applying for a loan from a commercial bank. Their income and credit record would be taken into account and the income versus the size of the loan would also be considered. Once the loan is issued by the employer the total amount lent would be taken into account by the ERS. For example if a company has 1 000 employees and out of those 900 qualify for the loans and the average loan size is SZL1 000 (the value discussed is SZL600 per level of energy efficiency but some might apply for SZL1 200 or SZL1 800 to buy level B or level A refrigerators), then the total value of the loan is SZL900 000 undertaken by the employer. This employer would then be afforded tax benefits related to this amount. One possibility is the reduction of its tax bill to the ERS by SZL900 000 or a percentage of the amount (or example 50% of it may be tax deductible). The other option is for the assets (refrigerators purchased by the employees) to become assets of the employer until the loans are repaid and for the depreciation of the assets to be accelerated, hence providing tax benefits through accelerated depreciation. From the above discussions an action plan for the implementation of financing mechanisms supporting the consumers of refrigerators is presented below.

6.1.1 ACTIONS FOR CONSUMER SUPPORT FUNDING

In terms of funding in support of the consumer the primary implementation plan is to attempt to enable on-wage financing mechanisms. Therefore, the plan is to engage with various institutions to understand their willingness to participate in such a plan. A task team will be set up to implement this. Prior to that however, discussions will be held within the ERS to understand the possibility of tax benefits for participating companies.

Therefore, the implementation plan is shown in Table 1 below.

Table 1. Implementation plan for On-wage financing

Action	Responsible	Timeline
Decide on possible tax benefits for companies participating in on-wage financing	ERS	End January 2023
Set up a task team to approach companies regarding participation	DoE	End January 2023
Engage companies and ascertain which are interested	Task team	End May 2023
Engage retailers to understand which will participate	Task team	End June 2023
Create legal/contractual framework	Task team and ERS	End July 2023
Print vouchers	Task team	Mid-August 2023
Advertise on-wage campaign (can be an addition to the consumer awareness campaign)	DoE and participating companies	Aug-Sep 2023
Implement roll-out of the campaign	Participating companies	Sep 2023 – Sep 2024
Monitor impact	Task team, DoE and participating companies	Jul 2024 – Sep 2024

As shown the impact of the roll out will be monitored. The monitoring will effectively occur throughout the programme as the participation will be verified and correlated with participating companies and participating retailers (in terms of vouchers issued vs vouchers spent). However, after one year of a roll out a further monitoring campaign will be carried out to understand how many employees of participating companies knew about the campaign. Additionally, the ease of utilization and experience will be assessed through interviews with certain consumers that participated in the programme. Furthermore, the companies will also be engaged to assess their experience with the programme, the repayment rates will be monitored and, if implemented, the success of the tax benefits scheme.

6.2 DISTRIBUTION TRANSFORMERS

Financial mechanisms are methods of accessing funding for the effective implementation of a strategy or project. In this case, financial assistance via various avenues is explored to promote a transition towards the use of more energy efficient distribution transformers in Eswatini.

Transformers are generally purchased in bulk by the key stakeholders in Eswatini and therefore require significant financial reserves and guarantees. Energy efficient distribution transformers have a higher initial cost and even though these costs are recovered by reducing the energy losses over the service life of the transformer, an additional burden is placed on the consumer at the point of purchase. The EEC obtains it's funding from the MNRE, which in turn applies for funding from the government of Eswatini. The funds are generally made available via loans obtained from lending institutions such as the World Bank and the

International Monetary Fund (IMF). It stands to reason that the EEC would need larger loans to cover the cost of energy efficient distribution transformers.

There are four financial mechanisms available to Eswatini to enable a transition to energy efficient distribution transformers. These mechanisms are expanded upon below.

6.2.1 FINANCIAL MECHANISMS FOR ENERGY EFFICIENT DISTRIBUTION TRANSFORMERS

6.2.1.1 REGULATORY FRAMEWORK FOR UTILITIES AND THE TOTAL COST OF OWNERSHIP MODEL FOR TRANSFORMER PROCUREMENT

The impact of losses in distribution transformers is felt throughout the electricity network. Higher losses require distribution and transmission grids to purchase greater quantities of energy, while electricity generators are required to produce a larger quantity of energy than would be required for systems with a higher energy efficiency. The costs of purchasing energy for distribution and transmission networks are therefore higher, while additional strain is placed on generation resources and equipment. In the case of Eswatini, energy is imported from South Africa and Mozambique to supplement local generation sources as there is insufficient generation capacity to meet the demand of the country. The shortage of generation capacity in South Africa therefore places the reliability of supply in Eswatini at risk. Eswatini also faces the prospect of a steep rise in tariffs from Eskom when the energy purchasing contract expires in 2025. It is therefore in the interest of the country to pursue lower losses via energy efficient distribution transformers provided that the total life cycle cost of energy efficient transformers outweighs the higher initial cost.

Progressive regulatory frameworks aim to incentivise both customers and utilities to incorporate the benefits of lower losses in such a manner that both parties' benefit.

It is a function of the country's energy regulator, ESERA, to promote the purchase of energy efficient transformers. The price control formulars must be executed in a manner such that the EEC and industrial uses are not punished for buying more expensive but more energy efficient transformers.

Utilities and other owners/users of distribution transformers should be incentivised to use a total cost of ownership approach to transformer procurement, where losses, carbon emissions and other environmental impacts are capitalised. The EEC and other owners/users of distribution transformers in Eswatini have purchased transformers based on the lowest capital cost. A transition to a TCO model will ensure that the higher initial cost of energy efficient transformer are balanced out (and overcome) by energy savings. The incentive should operate irrespective of whether the utility is responsible for buying or generating the electricity needed to supply system losses and would apply even when MEPS are in force [9]. The Total cost of ownership is calculated by the following formular [10]:

$$TCO = IC + A \times (P_0 + P_{C0}) + B \times (P_k + P_{CS} - P_{C0}) \quad \text{Eqn. A.1}$$

Where,

- *IC* is the initial cost of the transformer; this cost may include installation costs such as foundation and erection costs (requires a more sophisticated evaluation);
- P_0 is the no-load loss (kW) measured at the rated voltage and rated frequency, on the rated tap;
- P_k is the load loss (kW) due to the load, measured at the rated current and rated frequency on the rated tap at a reference temperature;
- P_{CS} is the total cooling power (kW) needed for operation at the rated power (including three winding operations if any) (note: this variable is set to zero for passively cooled transformer designs);
- P_{C0} is the cooling power (kW) needed for no-load operation (note: this variable is set to zero for passively cooled transformer designs);
- *A* is the cost of capitalisation of no-load losses in cost per kW including the cost of carbon emissions;
- *B* is the cost of capitalisation of the losses due to load in cost per kW including the cost of carbon emissions.

The stakeholders in Eswatini have been trained to use the TCO calculator developed during the execution of this project. As shown in section 3.5, the experiences of the state utility in South Africa, Eskom, prove that this model works in a Southern African context.

6.2.1.2 GUARANTEED SAVINGS MODEL VIA ENERGY SERVICES COMPANIES (ESCOs)

The guaranteed savings model is executed via Energy Services Companies (ESCOs), who play an important role in promoting energy efficiency. ESCOs provide turn-key technical solutions to build or upgrade electrical infrastructure that does not meet energy efficiency criteria. ESCO's perform energy analysis to determine the energy savings from their intervention. Performance guarantees (energy savings) based on the studies are stipulated in the contract between the customer and the ESCO. The customer secures funding for the project and is able to experience a return on investment from energy savings. The remuneration due to the ESCOs are a function of the performance contract. The added advantage of this system is that the energy performance must be monitored. Maintenance of the plant and performance audits are generally included in the contracts and ensure operational performance of the plant/system is maintained over an extended period.

6.2.1.3 BULK PROCUREMENT AND STANDARDISATION

The National Standard for Efficiency of Distribution Transformers in Eswatini [11] aligns with the MEPS stipulated by the Regional Standard for Efficiency of Distribution Transformers in SADC [12]. The requirement for distribution transformers with regards to MEPS will therefore by standardised across the entire SADC (South Africa is in alignment with the MEPS via their distribution transformer standard; SANS 780, 2019 South African National Standard, Transformers [13]). There are several common suppliers, mostly based in South Africa, that service the transformer market in the SADC. These suppliers have already made the necessary adjustments in terms of manufacturing facilities and techniques required to produce higher efficiency transformers in order to service the South African Market, and the South African State-owner electricity utility, Eskom. It is therefore unlikely that any costs pertaining to infrastructure improvements and improved designs would be reflected in the initial cost of distribution transformers required by stakeholders in Eswatini. Additionally, the standardisation of the MEPS in SADC would result in greater quantities of energy efficient transformers across SADC. This in turn should result in lower costs in the procurement of core steel and conductor due to the economies of scale. The increased initial cost of distribution transformers is expected to be mitigated by these factors.

6.2.1.4 ADJUSTMENTS IN MANUFACTURING FOR THE PRODUCTION OF ENERGY EFFICIENT DISTRIBUTION TRANSFORMERS

Data obtained from the United Nations Global Trade Repository, Comtrade [14], indicates that Eswatini obtains its transformers from South Africa, China and Pakistan. Transformer manufacturers in these countries are already supplying energy efficient transformers into these areas in accordance with the relevant in country MEPS. The Market Assessment Report for Distribution Transformers in Eswatini [3] indicates that the MEPS stipulated in these countries required more energy efficient transformers that are currently being supplied into Eswatini. The costs associated with improved manufacturing facilities and techniques have therefore already been realised and it is therefore unlikely that any costs pertaining to infrastructure improvements and improved designs would be reflected in the initial cost of distribution transformers required by stakeholders in Eswatini.

6.2.2 **RECOMMENDATION FOR FINANCING MECHANISMS FOR DISTRIBUTION TRANSFORMERS IN ESWATINI**

Financial supporting mechanisms are required in Eswatini to successfully adopt more energy efficient transformers in line with the requirements of the National Standard for Efficiency of Distribution Transformers in Eswatini [11]. Financial support is required for the various government entities to transition to energy efficient distribution transformers. The EEC and other prospective purchasers of energy efficient transformer in Eswatini

may pursue funding via the mechanisms described in this section. There is also the possibility of accessing funding for green projects - Several of the large banks that operate in Eswatini have specific mechanisms to fund “green” projects. This is typified by the joint initiative in 2014 between the African Development Bank and the government of Eswatini (via the EEC), which pledged to invest in schemes to expand energy supply and enhance the access to electricity in the country [15].

7 Conclusion of possible financing mechanisms for Eswatini

The Eswatini National Project related to energy efficiency of refrigerators and distribution transformers has resulted in a number of key developments. Amongst these the most important is the development of the Eswatini National Standard on energy efficiency of refrigerators and the national standard on efficiency of distribution transformers, which outlines the total cost of ownership methodology for distribution transformer purchases. In order to pursue the direction of increased energy efficiency of refrigerators and distribution transformers as outlined in these standards there is an initial cost increase of commodities. Both refrigerators and distribution transformers that are more efficient have a higher initial cost, even though their lifetime cost of ownership is lower. In order to enable the purchases of these commodities certain financing mechanisms have been discussed in this report. This report outlined financing mechanisms that are relevant to support general consumers in their desire to purchase more efficient refrigerators. Several possible financing mechanisms were discussed during the PWG meetings such as on-bill financing, on-wage financing, tax rebates, bank loans and direct loans. Through discussions the most suitable financing mechanism in Eswatini at this stage was found to be on-wage financing with a combination of tax benefits for companies that are willing to participate in the programme and provide loans to their employees. On-bill financing also remains a viable option although the EEC is not in a position to fund it at this stage. Other funding structures for the EEC to explore this financing mechanism have been outlined, including loans backed by government guarantees. Distribution transformers are purchased by large utilities or large power users (such as the Ubombo Sugar in Eswatini). The buying pattern is therefore completely different to that of refrigerators as are the funding mechanisms. Several mechanisms were discussed during the project and this report outlines some of the ones that are most applicable in Eswatini, including the bulk-savings model and bulk procurement. The advantage for Eswatini is that the majority of the transformers purchased are manufactured in South Africa and the South African manufacturers have already undergone adjustments (in terms of manufacturing techniques and equipment) to enable them to produce more efficient distribution transformers. The higher initial cost for more efficient transformers has already been implemented and absorbed by other purchasers, namely Eskom, and the pricing impact is not as high as it would have been several years ago.

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