National Policy Roadmap

Draft

LEAPFROGGING TO ENERGY EFFICIENT APPLIANCES AND EQUIPMENT (REFRIGERATORS AND TRANSFORMERS) IN ZIMBABWE

Draft Version

Basel Agency for Sustainable Energy (BASE)

International Copper Association (ICA)

Southern African Development Community's (SADC) Centre for Renewable Energy and Energy Efficiency (SACREEE)

September 2022

Table of Contents

List of Figures

List of Tables

List of Abbreviations

AEC	Allowable energy consumption
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
AV	Adjusted volume
CCMD	Climate Change Management Department
CO_2	Carbon Dioxide
COMESA	Common Market for Eastern and Southern Africa
CTCN	Climate Technology Centre & Network
DSM	Demand Side Management
DT	Distribution transformer
EE	Energy efficiency
EEI	Energy Efficiency Index
ESCO	Energy Service Company
GCF	Green Climate Fund
GDP	Gross domestic product
GHG	Greenhouse Gas
GWh	Gigawatt hours
GWP	Global Warming Potential
IDBZ	Infrastructure Development Bank of Zimbabwe
IEC	International Electrotechnical Commission
IPPs	Independent Power Producers
ISO	International Organization for Standardization
kV	Kilovolt
KVA	Kilovolt-ampere
LFIs	Local financial institutions
MECTHI	Ministry of Environment, Climate, Tourism and Hospitality Industry
MEPS	Minimum Energy Performance Standards
MoEPD	Ministry of Energy and Power Development
MoFED	Ministry of Finance and Economic Development
MoIC	Ministry of Industry and Commerce
MOU	Memorandum of Understandings
MRV	Monitoring, Reporting, and Verification
MV&E	Monitoring, Verification, and Enforcement
MVA	Megavolt-Ampere
MW	Megawatt

NDA	National Designated Authority
NDB	National Development Bank
NDC	Nationally Determined Contribution
NDE	National Designated Entity
NDS	National Development Strategy
NPR	National Policy Roadmap
NRM	National Roadmap
ODP	Ozone Depletion Potential
PRAZ	Procurement Regulatory Authority of Zimbabwe
PRS	Product Registration System
PWG	Policy Working Group
RE	Renewable energy
REF	Rural Electrification Fund
S&L	Standard and Labelling
SADC	Southern African Development Community
SAZ	Standards Association of Zimbabwe
TC	Technical Committees
T&C	Terms and Conditions
TCO	Total Cost of Ownership
TWG	Technical Working Group
U4E	United for Efficiency
UNEP	United Nations Environment Programme
USD	US dollar
ZELA	Zimbabwe Environmental Lawyers Association
ZERA	Zimbabwe Energy Regulatory Authority
ZESA	Zimbabwe Electricity Supply Authority
ZETDC	Zimbabwe Electricity Transmission and Distribution Company
ZIMRA	Zimbabwe Revenue Authority
ZimStat	Zimbabwe National Statistics Agency
ZNCC	Zimbabwe National Chamber of Commerce
ZPC	Zimbabwe Power Company

1 Background

As part of Zimbabwe's commitment to implement various energy efficiency strategies of the identified appliances and equipment, Ministry of Environment, Climate, Tourism and Hospitality Industry (MECTHI) submitted a request for technical assistance to Climate Technology Centre & Network (CTCN). This allowed Zimbabwe to be part of the eight countries in Southern Africa[1] embarking on Green Climate Fund (GCF) Readiness projects on *"Developing a national framework for leapfrogging to energy efficient appliances and equipment (refrigerators and distribution transformers) through regulatory and financing mechanisms"*. The project aims to enhance the country programs regarding refrigerators and distribution transformers and strengthen climate finance strategies. In addition, the project will be a key driver for good policy development and governance to inform the adequate measures. The key output of the project includes a National Policy Roadmap (NPR) and enabling environments for the implementation of standards and labels, appropriate financing mechanism to increase the uptake of energy efficient refrigerators and distribution transformers and contribute to capacity building to develop standards and labels for other appliances in future. [2]

1.1 Country Background and International Commitments

In 2015, Zimbabwe committed in its first Nationally Determined Contribution (NDC) submission to achieve a 33% reduction of its energy-related greenhouse gas emissions per capita below business-as-usual by 2030 (INDC, 2015). The updated NDC target is a 40% per capita emissions reduction across all sectors of the economy below the projected business as usual scenario by 2030.

Since 2020 Zimbabwe has made an additional regional effort in contributing to the harmonization of MEPS on residential refrigerators and air conditioners. The countries of the Eastern African and South African regions are working together with the project partners SACREEE, EACREEE and UNEP-U4E to develop harmonized MEPS and labelling. The project is particularly noteworthy in this context as it focusses on the same appliance as the national project for Zimbabwe, namely on energy efficient refrigerators.

The regional MEPS for refrigerating appliances has been drafted and is currently undergoing the voting process by Member States (MS), as required by the SADC Cooperation in Standardisation (SADCSTAN). Anteriorly, the project has also conducted a regional market assessment across both regions and developed technical notes that included technical recommendations on the MEPS development.[3]

An amended version of the distribution transformer (DT) model regulation developed by United for Efficiency (U4E) was recommended for implementation in all SADC GCF countries after significant PWG and TC consultations. The U4E Model Regulation Guideline 2019, on energy performance requirements for DTs, requires that DTs be reassessed for conformity as follows:

[1] The GCF Readiness Assessment project countries are Botswana, Eswatini, Lesotho, Malawi, Namibia, Tanzania, Zambia, and Zimbabwe

[2] U4E & UNEP (2021). Guidance Note for the Market assessment for energy-efficient residential refrigerators and distribution transformers.

[3] https://united4efficiency.org/country-regional-activities/eac-sadc/

- Comply with minimum energy performance in terms of the maximum allowed load and no-load losses
- Should not contain Polychlorinated biphenyls (PCB) contamination or other hazardous materials as defined in the relevant international, regional, and national regulations
- Product and technical information to include free access to websites of manufacturers and to durably mark on or near the rating plate of the distribution transformers
- Certification and registration to test transformer's energy performance by IEC 60076-1 and its fire performance in accordance with IEC 60076-11, for instance, for dry-type transformers and related reference test standards

1.2 Electricity Context in Zimbabwe

Zimbabwe has an installed capacity of about 2,300 MW, with Zimbabwe Power Company (ZPC), a generation subsidiary of ZESA, the national utility, owning around 95% of this. More than 50% of electricity is generated from Kariba Hydro Power plant, while the remainder is from thermal power plants and IPPs. Bagasse, mini hydropower, and small sized grid connected solar systems have an installed capacity of about 130 MW. Against this background, the actual power generation capacity in 2019 was less than 1,000 MW against a peak demand of about 1,700 MW. Zimbabwe is importing 50 MW firm power from HCB, Mozambique, and around 300 MW non-firm power from ESKOM, in South Africa. The country is also exporting around 80 MW of power to NamPower, Namibia based on a commercial agreement between ZPC and NamPower (ZERA, 2019). Approximately 40% of the country's electricity demand is driven by mining and other heavy industries. Peak demand has been recorded at 2,200 MW (GET.invest, 2021).

1.2.1 Electricity Demand

Figure 1-1 shows that in 2019 the mining and manufacturing sectors consumed 48% of the electricity, an increase from 41% in 2018. The domestic sector is the second largest consumer of electricity at 26%, down from 28% in 2018. Most of the domestic consumers are on a pre-payment metering system. With pre-payment metres, consumers can more easily correlate relate electricity consumption and cost. This has a positive impact on promoting energy efficiency measures.

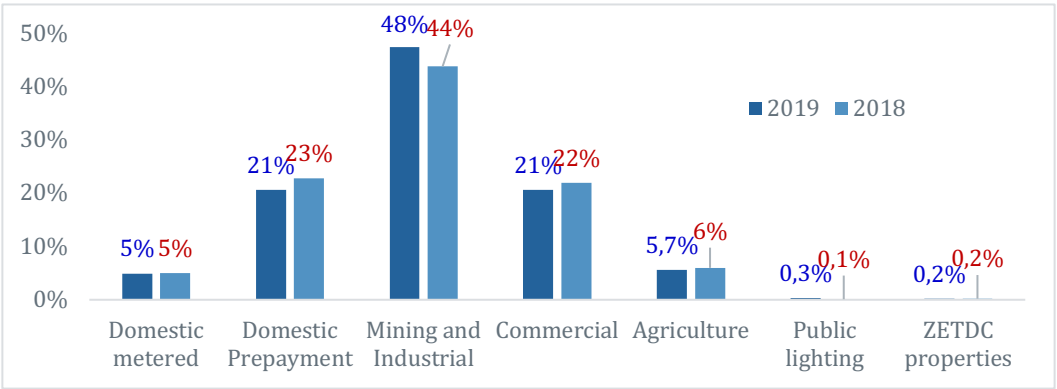

Figure 1-1: Electricity consumption by sector

Source: ZERA, 2021

1.2.2 Access to Electricity

In Zimbabwe, the electricity access of the urban households was 85% in 2019 while that of the rural households was only 20% (World Bank, 2019). The mandate of the Rural Electrification Programme (REF) is to facilitate rapid and equitable electrification of rural areas in Zimbabwe, in line with the Rural Electrification Fund (REF) Act 13.20 of 2002. The REF's mission is to empower rural communities in Zimbabwe through harnessing energy resources to ensure that all the people have access to adequate, reliable, least-cost and environmentally sustainable energy services. During the period 2015-2016, REF developed the Rural Energy Master Plan (REMP) which is meant to provide a systematic and realistic approach to how Zimbabwe's rural areas can be provided with modern energy services. The energy services include:

- Electrical energy services (lighting, refrigeration, entertainment, etc.)
- Thermal energy services (food processing and preparation, space heating, etc.)
- Productive energy needs (irrigation, commercial and business processes, agro-processing, and cottage industries)

1.3 National Policies on Energy, Energy Efficiency, and Conservation

Zimbabwe is committed to taking urgent action to mitigate and adapt to the effects of climate change. To contribute to the ambitious global mitigation goals as agreed under the Paris Agreement, the long-term L*ow Greenhouse Gas Emission Development Strategy (LEDS 2020-2050)* was launched in 2019, which aims to set the course for reducing emissions, and ensuring sustainable economic development for the country. One of the energy sector mitigation projects of the *LEDS 2020-2050* is to increase energy performance of appliances leading to reduced grid power consumption.

The draft *National Energy Efficiency Policy (NEEP)* has been also prepared and set out the main goal to encourage the adoption of energy efficiency strategies through developing mechanisms and regulations targeted at MEPS – to promote the use of energy-efficient appliances and equipment such as fridges, air conditioners, motors, light bulbs, magnetic ballasts, fluorescent lamps, computers, TVs, cookers, dishwashers, washing machines, dryers, and cookstoves.

More details about Zimbabwe's energy policies can be found in ANNEX D – Acts and Policies.

1.4 Key Institutions & Recommended Roles

The key institutions that are expected to play a significant role in promotion of energy efficient refrigerators and distribution transformers in Zimbabwe are summarised in Table 1-1.

Table 1-1: Key Institutions in Zimbabwe

Main Organisation	Description/ Role
Ministry of Energy and Power Development (MoEPD)	The Ministry of Energy and Power Development (MoEPD) is responsible for energy and electricity in Zimbabwe. The Ministry is mandated to formulate, coordinate, promote and implement the energy policies and plans (MEPS and labelling program)
Zimbabwe Energy Regulatory Authority (ZERA)	The Zimbabwe Energy Regulatory Authority (ZERA), under MoEPD, is mandated to regulate the procurement,

Main Organisation	Description/ Role
	production, transport, transmission, distribution, importation, and exportation of energy derived from any energy source. ZERA is the potential regulator for energy efficient refrigerating appliances and distribution transformers.
Zimbabwe Revenue Authority (ZIMRA),	The Zimbabwe Revenue Authority (ZIMRA) is responsible for assessing, collecting, and accounting for revenue on behalf of the State through the Ministry of Finance and Economic Development. Customs Division, under ZIMRA, monitors the entry of electrical appliances and works with SAZ to carry out compliance checks on imported products under MEPS and labelling program.
Zimbabwe National Statistics Agency (ZimStat)	The Zimbabwe National Statistics Agency (ZimStat), under the Ministry of Finance and Economic Development, is the main government department responsible for the collection and dissemination of official statistics. Data information for trade statistics of refrigeration and distribution transformers can be obtained from ZimStat.
Climate Change Management Department (CCMD)	Climate Change Management Department (CCMD) is under the Ministry of Environment, Climate, Tourism and Hospitality Industry (MoECTHI). CCMD, as the National Designated Authority (NDA), is responsible for the formulation, review, and implementation of policies and legislation for environmental protection.
National Ozone Unit (NOU)	The National Ozone Unit, under the Ministry of Environment Climate, Tourism and Hospitality Industry (MECTHI), is a national body that oversees matters related to the compliance and implementation of the Montreal Protocol. NOU is at the forefront of phasing out HCFCs and promoting environmentally friendly and energy efficient products.
Rural Electrification Fund (REF)	The Rural Electrification Fund (REF) is a statutory body governed by the Rural Electrification Fund Act (Chapter 13:20). The major thrust of the Rural Electrification Fund is to ensure that there is equitable distribution of resources in the electrification of rural areas in Zimbabwe. REF provides information on transformer asset registers, standards, regulations, and efficiency specifications.
Standards Association of Zimbabwe (SAZ)	The Standards Association of Zimbabwe (SAZ), through its Standards and Information Division, assumes overall responsibility for the development of Zimbabwean National Standards and related publications in all fields, including those covered by the IEC. In addition, SAZ is a provider of conformity assessment services in the electrotechnical field. SAZ provides standards relevant to the manufacture and supply of refrigerators and transformers in general.

Main Organisation	Description/ Role
Zimbabwe Electricity Supply Authority (ZESA)	The Zimbabwe Electricity Supply Authority (ZESA) is a state-owned company responsible for the generation, transmission, and distribution of electricity in Zimbabwe.
Zimbabwe Electricity Transmission and Distribution Company (ZETDC)	The Zimbabwe Electricity Distribution Company's business is the distribution and retail of electricity to the final end user. ZETDC provides information on transformer asset registers, standards, regulations, and efficiency specifications. ZETDC also supports the implementation of MEPS and labelling programs and financing mechanisms (e.g., on-bill financing/repayment, bulk procurement)
Consumer Council of Zimbabwe (CCZ)	The Consumer Council of Zimbabwe (CCZ) provides information on the protection of electricity consumers.
Financial Institutions/ Association	Financial Institutes/ Association will play a key role in developing, implementing, financing, and promoting the mechanism. • Infrastructure Development Bank of Zimbabwe (IDBZ) • ZB Bank • Agribank • Bankers Association of Zimbabwe

2 About the National Policy Roadmap

2.1 Scope

The NPR aims to provide technical guidance to improve Zimbabwe's programming process to leapfrog to energy efficient refrigerators and distribution transformer and further strengthen climate finance strategies. Specifically, the NPR aims to:

- Create an enabling policy and regulatory environment for the adoption of energy efficient refrigerators and distribution transformers in Zimbabwe through the development of mandatory Minimum Energy Performance Standards (MEPS) for domestic refrigerators and distribution transformers and a labelling scheme for domestic refrigerators.
- Enable the development of appropriate financing mechanisms to accelerate deployment of energy efficient domestic refrigerators and distribution transformers.
- Contribute to capacity building to develop standards and labels for other appliances in the future.
- Transform the market to energy-efficient domestic refrigerators and distribution transformers.
- Reduce the strain on the electricity grid and improve the quality of supply.
- Increase disposable income for household and potentially reduce greenhouse gases (GHG) emissions.

2.1.1 Roadmap Development Process

In order to ensure participation of national stakeholders throughout the development of the NPR, the Policy Working Group and Technical committees for distribution transformers and refrigerating appliances were established and consulted extensively.

Policy Working Group

The objective and mandate of the Policy Working Group (PWG) was to ensure coherence and synergy between the national policy roadmap and the regulatory framework for higher efficiency residential refrigerating appliances and distribution transformers and the national policies on energy efficiency. The role of the Policy Working Group was to assist in the development of the national policy roadmap for refrigerating appliances and distribution transformers which included:

- Minimum Energy Performance Standards (MEPS) and Higher Energy Performance Standards (HEPS)
- Labelling options and decide on labelling scheme
- End-users' awareness campaign
- Public consultations
- Financing mechanisms
- Monitoring, verification, and Enforcement (MV&E) plan

The list of institutions and members represented in the Policy Working Group is found in Annex A.

Technical Committee

The objective and mandate of the technical committees was to support the development of the NPR (led by the PWG) by reviewing MEPS and testing standards to be adopted for distribution transformers and refrigerating appliances. The list of institutions and members represented in the technical committees are found in Annex B for refrigerating appliances and Annex C for distribution transformers.

2.2 Energy Efficiency Implementation Ecosystem

The NPR for leapfrogging to energy efficient refrigerators and distribution transformers comprises of five elements:

1. MEPS
2. Labels
3. Communication - Consumer and Stakeholder Education
4. Monitoring, verification, and Enforcement (MV&E)
5. Financing mechanisms

A holistic interaction between these elements ensures successful creating an enabling policy and regulatory environment and market transformation for refrigerators and distribution transformers including the ability for continuous improvement in the energy performance in Zimbabwe.

3 Refrigerators

The refrigerator demand in Zimbabwe is met by both local manufactured and imported products. Capri and Imperial are the major manufacturers of refrigerators in the country, while PrimePep Services (T/A Tradecom Africa), Mahomed Mussa, TV Sales & Home and OK Mart are the major wholesalers/retailers. Capri and Imperial's production in 2020 ranged from 50% to 60% of the refrigerators sold. The trade statistics in

Table 3-1 show that imports were much higher than exports for the period 2010-2020, meaning that local manufacturing has been failing to meet demand for refrigerators. The supply chain actors are of the opinion that 40% to 50% of the demand is met through imports. However, only 2011, 2012 and 2014 imports would be above 40% of the market size of 20,000 to 35,000 residential refrigerators while imports for the other years, including the years 2015-2020 had very low imports.

Table 3-1: Imports and exports of refrigerator units during the period 2010-2020

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Imports	3272	17031	17247	4660	9204	4856	4748	1851	2723	2663	2094
Exports	5	15	13	82	52	67	1045	180	1	2362	131

Source: Zimstat, 2021

Although Zimbabwe imports a lot of refrigerators from countries outside Africa, it imported significant quantities from some SADC countries such as South Africa and Eswatini. Zimbabwe exported significant quantities of chest freezers to Zambia and Malawi. South Africa is the major African trade partner with 99.5% and 85% of 2010-2020 cumulative share of imported household refrigerators and chest freezers, respectively. As such, the market in Zimbabwe is already familiar with the South African' labels affixed on refrigerators.

Using the 40.3% as percentage of households with refrigerators in Zimbabwe in 2019 (Global Data Lab, 2021) gives a 2019 residential refrigerator total stock of 1.35 million. Assuming a residential refrigerator lifespan of 15 years would mean that refrigerators would be replaced at a rate of 7% per year, and 90,000 refrigerators would have been replaced in 2020. It is also assumed that the number of residential refrigerators would increase with increases in GDP growth as disposable income of households improve. Using the 2009-2019 GDP growth rate of 6.4% (World Bank, 2021) gives a residential refrigerator market growth of 87,000 in 2020, increasing the total stock of residential refrigerators from 1.35 million in 2019 to around 1,44 million in 2020, 2.7 million in 2030 and to just above 5 million in 2040. The total market size (due to replacement of old refrigerators and entry of new ones) and the total market value of the residential refrigerator would also increase as shown in Figure 3-1 and Figure 3-2 Figure 3-1: Projected market size and stock of residential refrigerators for the period 2020-2040

Source: Market Assessment, 2021

respectively. The refrigerator price used to estimate the market values was USD 486.

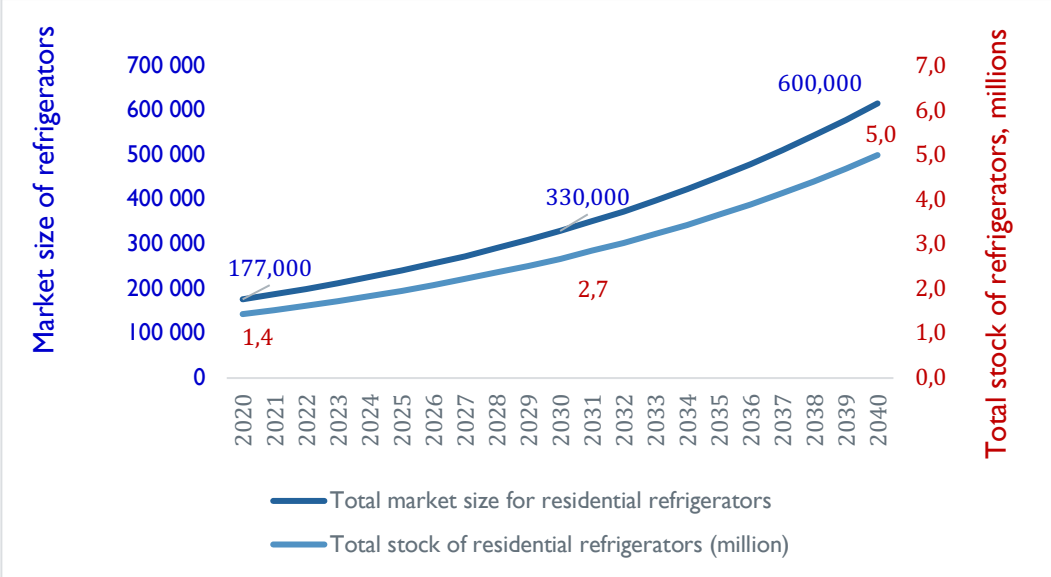

Figure 3-1: Projected market size and stock of residential refrigerators for the period 2020-2040

Source: Market Assessment, 2021

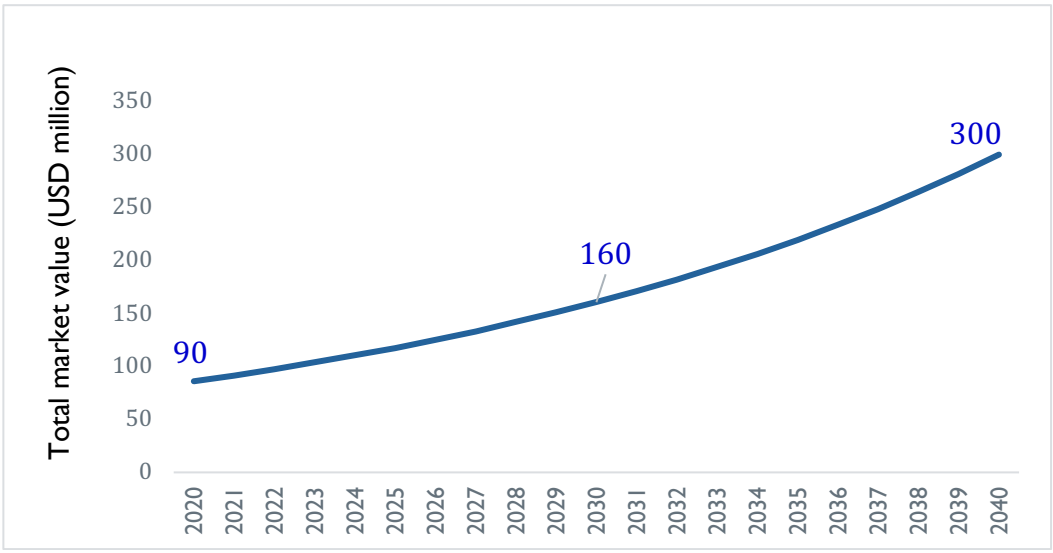

Figure 3-2: Projected total residential refrigerator market value for Zimbabwe for the period 2020-2040

Source: Market Assessment, 2021

Only 11 refrigerator models out of 101 manufactured and supplied by the local manufacturers had energy consumption information written on the refrigerators. The average energy consumption was 344 kWh while the corresponding volumes gave an average of 222 L. Multiplying the market size and the percentage of the locally made refrigerators gives a trend of locally manufactured refrigerators, which ranged from 68,000 in 2021 to 120,000 in 2030 and 222,000 in 2040. According to the household survey the percentage of the frost-free refrigerators increased from 30% in 2011 to 55% in 2021. Extrapolation gives 66% and 79% as the percentages of the frost-free refrigerators in 2030 and 2040 respectively. Under the business-as-usual scenario the more efficient residential refrigerators will be expected to

increase from 55% in 2021 to 79% in 2040, hence the need for a framework to leapfrog to more efficient refrigerators.

3.1 Minimum Energy Performance Standards

3.1.1 Current Situation

Local manufacturers in Zimbabwe have adopted either ASHRAE-72 (which is not ideal for domestic refrigerators) or SANS 62552 as the test standards. Since South Africa is considered the major trade partner with 76% of residential refrigerators market share in Zimbabwe, the imported units from South Africa are generally tested according to the South African test standard SANS 62552-2008. SANS 62552-2008 standards contain both the test method and the labels for South Africa, based on IEC 62552-2007. The remaining units are imported from China, Europe, and India, which are typically tested according to IEC 62552-2015.

In South Africa, the VC9008 Regulation sets the MEPS rating at the Label Class B (55 ≤EEI<75) and Class C (75≤EEI<90) for refrigerators-freezer and freezers, respectively. Energy Efficiency Index (EEI) is the energy consumption ratio for an individual product as measured in accordance with the test method over the reference for the product size and category. The official test method for the performance of refrigerators is cited in SANS 62552/IEC 62552 – Household Refrigerating Appliances – Characteristic and Test Methods.[4] The existing MEPS of South Africa is currently under revision; it plans to adopt IEC 62552:2015 which will advance to A+ in 2022 for refrigerators products, and the C label intends to advance to A in 2022 and A+ in 2026 for freezers. Most of the refrigeration appliances available to consumer in South Africa market were rated as Class ''A'' per the South African regulation. And 70% of imported product into Zimbabwe market were "A" rated appliances; we can consider it to be the baseline energy efficiency level.

3.1.2 Recommended MEPS

Currently, Zimbabwe does not have a mandatory MEPS, and the technical committee recommended starting with a voluntary MEPS following the SADC harmonised MEPS. The SADC Cooling Project developed a harmonized MEPS for refrigeration appliances based on the IEC 62552-2015, 1,2,3 test standard with progressive maximum allowable energy consumption (AEC_{max}) with an ambient reference temperature of 24°C.

The second version of the ICS 97.040.30 dated 26 July 2022 "Minimum Energy Performance Standards for Foodstuffs Refrigerating Appliances" provides means to set the minimum energy performance standard based on "R" which is the ratio of the maximum annual energy consumption "AEC_{Max}" to the annual energy consumption "AEC" calculated based on the daily energy consumption "E_{daily}" in accordance with IEC 62552-3: 2015. The current implementation schedule for the proposed MEPS levels is as follows:

- By 2023: Phase 1 of implementation, R = 1.0
- By 2026: Phase 2 of 25% more stringent, R = 1.25

[4] Overview of the Market on Refrigerating Appliances and Room Air Conditioners in East and Southern Africa https://united4efficiency.org/wp-content/uploads/2021/04/SADC_EAC_Market-Assessment_Cooling_20210205_Final.pdf

AEC_{Max} is calculated for the different equipment classes, as shown in Table 3-2.

Table 3-2: Maximum Annual Energy Consumption for a Reference Ambient Temperature of 24°C.

Product Category	AEC_{Max} (kWh/year)
Refrigerators	0.163×AV+102
Refrigerator-Freezers	0.222×AV+161
Freezers	0.206×AV+190

The draft MEPS suggests that R should be greater than or equal to 1.0 for the first phase of MEPS implementation and 1.25 for the second phase and beyond. The minimum R requirement for refrigerating appliances is shown in Table 3-3. In addition, the countries can make additional tiers to support the setting of high energy efficiency targets in accordance with IEC 62552-2015, based on the country's national circumstances.

Table 3-3: Minimum R Requirements for Refrigerating Appliances

Product Category	R Requirement (Phase 1: by 2023)	R Requirement (Phase 1: by 2026)
Refrigerators	1.0	1.25
Refrigerator-Freezer	1.0	1.25
Freezers	1.0	1.25

Source: Proposed Regional Minimum Energy Performance Standards for Refrigerating Appliances, 26 July 2022
Note: R = AEC_{max}/AEC.

Furthermore, the draft MEPS should include provisions limiting the GWP of the refrigerant used in the vapor compression cycle, and the foam blowing to 20, and the Ozone Depleting Substances (ODS) to 0. The draft MEPS also reference to the IEC 60335-2-24 to ensure safety when a flammable refrigerant is used.

Testing Standard

Adopting a test standard is considered as a cornerstone of the regulatory environment. The test standard method indicates how appliances' energy efficiency is evaluated. It is imperative that Test standards and MEPS must not disrupt the market and create more market-entry barriers; hence, coordination and harmonization with major trade partner(s) standards are of prime importance. Regional harmonization with the major trade partner, South Africa, may result most cost-effectively since Zimbabwean consumers are already familiar with the South African Label.

Energy efficiency standards and labels (S&L) are based on energy consumption values obtained from test standards. At the same time, the standard for measuring refrigerator energy consumption is broadly similar across countries. Many countries adopt or refer to IEC 62252 standards; for example, Brazil, China, the European Union (EU) 2009 regulation, South Korea, and South Africa had/have their standards based on IEC 62552:2007, which use an ambient temperature of 25°C.

IEC 62552:2015 for household refrigerators was recently developed to harmonize international residential refrigeration testing and efficiency metrics. This standard enables manufacturers to derive fair and comparable figures for annual energy consumption (kWh/year) and make suitable calculations for local climate conditions and policy needs based on two tests (one at 16°C and one at 32°C ambient).

IEC 62552: 2015 is favoured because it includes flexibility for adaptation of results to suit local climate and internal storage temperatures but ensures comparability of results between economies. Economies that are recommended to consider basing their policies on IEC 62552: 2015. China, Chinese Taipei, the EU, Indonesia, Japan, Kenya, Malaysia, and Thailand have already moved to, or are planning to, adopt the IEC 62552-2015 that measures energy consumption at both 16°C and 32°C, enabling improved information on the likely field performance of refrigerating appliances.[5]

The IEC 62552-3: 2015 is the recommended test standard by the SADC/EAC MEPS that is based on the global U4E tool. It is recommended to establish Zimbabwe's MEPS with the test standard of IEC 62552-3: 2015.

3.1.3 Actions & Timeframe

According to UNEP-U4E[6], the MEPS development process involves several steps as shown in Figure 3-3. The overall responsibility of the NPR implementation and MEPS regulation lies with the MoEPD to establish a legal framework and guidance on policy and execution for household refrigerators. MoEPD will also have the function of coordinating and involving relevant Ministries and Agencies in this effort. Other key government agencies that will support the implementation of the National Policy Roadmap within the scope identified by their mandate and relevant policies include the Zimbabwe Energy Regulatory Authority (ZERA), Standards Association of Zimbabwe (SAZ) and the Zimbabwe Revenue Authority (ZIMRA).

It is necessary to obtain high-level political buy-in from relevant government agencies with appropriate authority and mandate in the country, to ensure sufficient political support in developing the NPR and establishing the mandatory MEPS. It will also rely on the extensive participation of all relevant national stakeholders that will be involved in the detailed formulation process. The Policy Working Group (PWG) members have identified that ZERA would be the most cognizant government authority to be the custodian of the standard.

The MEPS development process should include consultation with the following stakeholders:

- SAZ
- PWG members
- Manufacturers
- Trade industry representatives
- Consumer representatives

In collaboration with the Ministry of Energy, the focal agency (ZERA) will play a leading role in developing and implementing the MEPS standards and labelling. ZERA will facilitate the

[5] Technical Note on Quality and Performance Metrics of Cooling Product for East African Community (EAC) and Southern African Development Community (SADC), United Nations Environment Programme-United for Efficiency, 2021

[6] UNEP/U4E: Policy guidebook for climate-friendly and energy-efficient refrigerators. Available at: https://united4efficiency.org/resources/

identification and engagement of other necessary government agencies and key stakeholders and coordinate their effort and inputs.

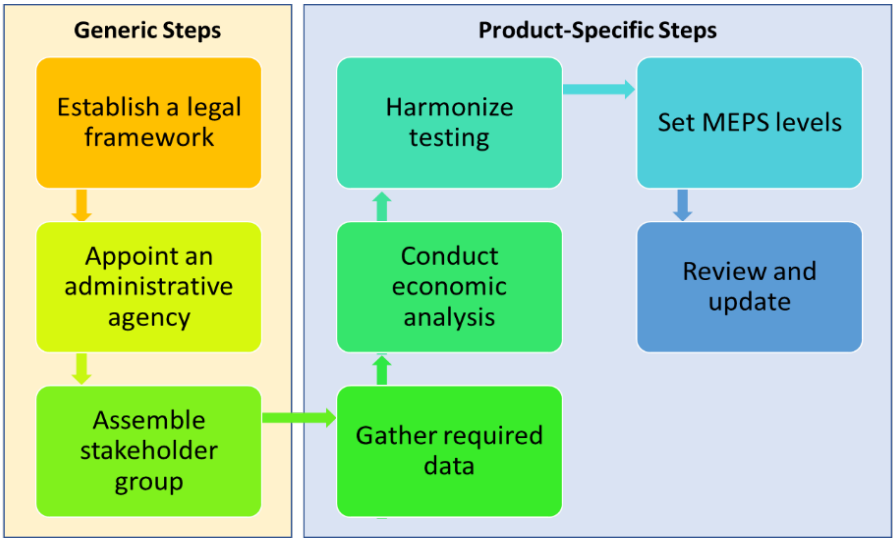

Figure 3-3: MEPS Development Framework

Source: UNEP/U4E: Policy guidebook for climate-friendly and energy-efficient refrigerators. Available at: https://united4efficiency.org/resources/

Table 3-4 lists actions for development of mandatory MEPS. It also includes country-specific activities that will support the future decision for ZERA, MoEPD and SAZ to harmonize MEPS and testing methods with the SADC harmonised MEPS.[7]

Table 3-4: Action Plan for Development of Mandatory MEPS and Harmonization of Testing Methods

Action	Lead Agency & Other Stakeholders	Timeframe
1. Develop an implementation plan on national policy roadmap	MoEPD/ ZERA/ SAZ/ ZIMRA/ International & National advisor	2023
2. Finalise the draft MEPS for voluntary implementation	ZERA/ SAZ	2023
3. Establish/designate the Authority (preferably ZERA) to regulate refrigerating appliances	MoEPD/ ZERA	2023
4. Develop and implement a capacity building and training program for ZERA and ZIMRA on implementing of mandatory MEPS to effectively regulate the refrigerating products	MoEPD/ International Partners	2024

[7] Technical Note on Quality and Performance Metrics of Cooling Product for East African Community (EAC) and Southern African Development Community (SADC), United Nations Environment Programme-United for Efficiency, 2021

Action	Lead Agency & Other Stakeholders	Timeframe
5. Conduct public consultation on the voluntary MEPS to become mandatory	Regulator (ZERA) designated to regulate the refrigerating appliances	2024
6. Develop regulatory mechanisms to enforce mandatory MEPS and testing methods	MoEPD/ ZERA/ ZIMRA	2025
7. Promulgate the mandatory MEPS regulation	ZERA/ MoEPD/ Cabinet and Parliament	2025
8. Enforce the mandatory MEPS	ZERA/ MoEPD	2026
9. Review and adjust the MEPS level based on the analysis of statistical data collected and the regional harmonisation trend	SAZ/ ZERA/ ZIMRA	Every 5 years

3.2 Energy Labelling

3.2.1 Current Situation

Zimbabwe does not have a mandatory MEPS regulation. As mentioned earlier, South Africa is the major African trade partner with 99.5% and 85% of 2010-2020 cumulative share of imported household refrigerators and chest freezers, respectively. 76% of the current refrigeration appliance market in Zimbabwe is already familiar with the South African Energy Efficiency label. The South Africa label is shown in Figure 3-4.

The Cost-effective implementation of Mandatory MEPS and Labels may be achieved through regional harmonization (as with the SADC/EAC MEPS) or the adoption of international or major trade partner standards.

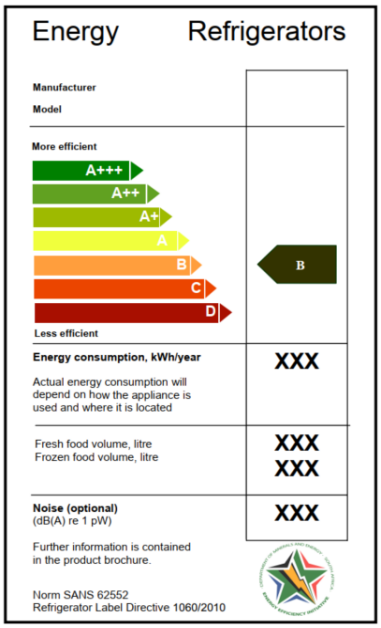

Figure 3-4: South African Residential Refrigerator Energy Efficiency Label

In the South Africa label, Energy Efficiency Index (I) is used to determine the energy label class for refrigerators and freezers, where "*I*" is the ratio of the annual energy consumption (AEC) to the max allowable annual energy consumption (AEC_{max}) multiplied by 100. Energy efficiency level in the South African label is designed on 7 levels, with D being the least efficient and A+++ being the most efficient on the market. The annual energy consumption of each refrigerator model is tested according to SANS 62552:2008 test standard and presented in unit kWh/yr. Note that the current MEPS in South Africa is set a level "B" for refrigerators and refrigerator-freezers and level "C" for freezers. The correlation between energy efficiency index and energy efficiency level is shown in Table 3-5.

Table 3-5: Correlation between Energy Efficiency Index and Energy Efficiency Level

Energy Efficiency Index, *I*	Energy Efficiency Level
$I < 22$	A+++
$22 \leq I < 33$	A++
$33 \leq I < 42$	A+
$42 \leq I < 55$	A
$55 \leq I < 75$	B
$75 \leq I < 95$	C
$95 \leq I$	D

3.2.2 Recommended Energy Labelling

Energy efficiency rating and labelling have been key contributors to the market transformation of household appliances towards more energy-efficient models. Labelling is an effective tool to inform the consumer about the energy consumption of the electrical good. Labels provide a mechanism for customers to understand the relative performance of the appliance or equipment against other technologies on the market. The label's design is critical in its ability to convey the message clearly and simply to consumers to help them with their purchase decision. It is critical that consumers can understand the information provided on the label in a way that encourages them to purchase the most efficient refrigerator.

In general, designing comparative labels and energy labels requires a lengthy and costly step-by-step approach to ensure that the correct information is displayed, the messages are clearly understandable, and that consumers widely accept the label. The design of such labels should consider international alignment opportunities or further consider aligning with regional harmonization with the major trade partner.[8] Such alignment would bring significant benefits, including:

- Avoiding or reducing the cost of developing a new label.
- Reducing compliance cost for manufacturers and importers.
- Facilitating market verification and enforcement.

A phased step approach was recommended by the TC and PWG for establishing and implementing the labelling program as follows:

- **Phase 1**, accept South Africa as is with an optional Zimbabwe/SADC specific label

[8] UNEP/U4E: Energy labelling guidance for lighting and appliances. Available at: https://united4efficiency.org/resources/

For the short-term, adopting the South Africa label with relevant modifications to ensure local and regional context is recommended. This would require proper discussion with the South African authorities to investigate legal issues related to the direct use of their label.

- **Phase 2**, adopt Zimbabwe/SADC Specific Label

It is essential to ensure that Zimbabwe's labelling requirement is harmonized regionally and between SADC countries (including Zimbabwe) and South Africa for the medium to long term. The SADC/EAC MEPS document suggests the use of 4 levels for energy efficiency levels[9] corresponding to the value of the energy consumption index, $R = AEC_{max}/AEC$, as follows:

  - Low; corresponding to MEPS in 2023 ($1.0 \leq R < 1.25$).
  - Intermediate 1; corresponding to MEPS in 2024 ($1.25 \leq R < 1.50$).
  - Intermediate 2 ($1.50 \leq R < 1.75$).
  - High ($1.75 \leq R$).

Table 3-6: Labelling Requirements for Refrigerating Appliances

Category	Low	Intermediate 1	Intermediate 2	High
Refrigerators	$1.00 \leq R < 1.25$	$1.25 \leq R < 1.50$	$1.50 \leq R < 1.75$	$1.75 \leq R$
Refrigerator-Freezers	$1.00 \leq R < 1.25$	$1.25 \leq R < 1.50$	$1.50 \leq R < 1.75$	$1.75 \leq R$
Freezers	$1.00 \leq R < 1.25$	$1.25 \leq R < 1.50$	$1.50 \leq R < 1.75$	$1.75 \leq R$

Source: Proposed Regional Minimum Energy Performance Standards for Refrigerating Appliances, 26 July 2022

While the lower energy efficiency index (I) refers to higher energy efficiency under the South African label, the higher energy consumption index (R) refers to higher energy efficiency under the SADC/EAC MEPS. The label should Indicate the current MEPS level (if it is more stringent than South Africa), including relevant seal for Zimbabwean authorities such as ZERA, SAZ, as shown in Figure 3-5. In addition, it should include the country of origin and refrigerant data as stated in the SADC/EAC MEPS.

[9] Additional levels of energy labelling requirement could also be incorporated in the future.

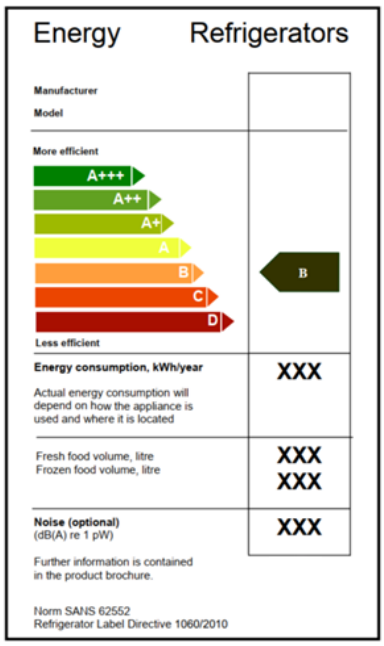

Figure 3-5: Zimbabwe Specific Label carrying the Proper Seal of the Zimbabwean Authorities.

The design of the label is required the following information on the energy label:

- Model name / serial number
- Type of unit [refrigerator, refrigerator-freezer, or freezer]
- Country where the product was manufactured
- Volume of the different compartments and an indication of whether they are frost-free
- Rated performance grade (Low Efficiency, Intermediate, and High Efficiency)
- Yearly energy consumption in kWh at ambient temperature in °C or °F
- Reference ambient temperature[s] used in performance rating
- Refrigerant and foam-blowing designation in accordance with ISO 817 or ASHRAE 34, including ODP and GWP

3.2.3 Actions & Measures

The focal agency (ZERA) will play a leading role in developing and implementing the MEPS standards and labelling. ZERA will facilitate the identification and engagement of other necessary government agencies and key stakeholders, and coordinate for their effort and inputs.

Table 3-7 lists a matrix of the course of action for establishing and implementing the labelling program. It also includes future actions and measures supporting the MEPS and Labelling program.

Table 3-7: Action Plan for Establishing and Implementing Energy Labelling Program

Action	Lead Agency & Other Stakeholders	Timeframe
1. Phase 1- Conduct consultation workshops to discuss with the South African authorities and adopt the South Africa label with relevant modification on the labels.	MoEPD/ SAZ/ ZERA	2023 to 2024
2. Conduct market assessment to determine the initial impact of voluntary energy labelling implementation	ZERA/ SAZ/ ZIMRA	2024 to 2025
3. Phase 2-Develop a uniform energy performance labelling for all residential refrigerators sold in Zimbabwe. (In coordination with the mandatory MEPS regulation)	MoEPD/ SAZ/ ZERA	2025
4. Develop a labelling regulation on requiring all residential refrigerators imported to and sold in Zimbabwe be compliant with the mandatory labelling requirement	MoEPD/ ZERA/ SAZ/ ZIMRA	2025

3.3 Communication Program

3.3.1 Current Situation

Households have different preferences when purchasing a refrigeration unit. Based on the survey about the factors that influence on refrigerator purchasing decisions. “Functionality” was selected as the factor with the highest influence on refrigerator purchasing decisions at 9.1% followed by “quality” and “price” at 9.0% and 8.9% respectively. “Access to financing” and “recommendations from other people” were deemed least important, as they had the lowest ratings.

Considering that energy-efficient refrigerators could cost more than ordinary standard efficiency refrigerators, this poses a major challenge to scaling up the adoption of energy efficiency and climate-friendly residential refrigerators into the market. Based on the survey, consumers’ response to the importance of energy efficiency as a factor impacting the purchase of refrigerators was equally between strongly disagree and somewhat agree. 55% of the consumers are willing to pay an extra cost of up to 10% for a more efficient refrigerator while only 5% would tolerate a 40% additional cost.

3.3.2 Recommended Communication Plan

Consumer and stakeholder awareness and education are important to the energy-efficient market transformation ecosystem. All stakeholders need to understand the value of MEPS and their roles in energy efficiency market transformation, which is an important pillar of the ecosystem. It is essential to ensure that the consumer and the technology provider throughout the supply chain are well educated about energy efficiency's value. The service

provider can better advise and convince consumers to opt for higher efficiency products to ensure that consumers understand the labels and purchase the most efficient products. It is also vital to ensure that government officials understand the value of energy efficiency and how to create the appropriate supporting policies.

Proper consumer and stakeholder education may involve capacity-building activities, awareness campaigns, communication plans, etc. Awareness-raising communication campaigns must accompany any labelling program to ensure consumers understand the labels and purchase the most efficient products. Such campaigns must target not only end-users but also strategic intermediaries (salespersons, retailers, importers) with active support from the media.

This can be facilitated by:

- Government and institutions who support regulatory and legislative work and oversee policy implementation
- Retailers and distributors who facilitate education of end-users through advertising and training of salespersons
- Media that engage end-users in communication and awareness campaigns
- Power utilities: develop and maintain incentive schemes
- End-users who should receive clear information and messaging to help make informed decisions

Awareness and training activities should be directed to consumer and retail personnel on the benefits of efficient refrigerators, with information exchange workshops on promotion campaigns in small cities and rural towns. More skilled and knowledgeable retail staff or other professionals that give advice options can be complemented by more extensive point-of-sale information in terms of information posters or signage.

ANNEX L – Awareness Raising and Education Campaigns further outlines international best practices.

3.3.3 Actions & Timeframe

Table 3-8 lists key actions for implementing communication plan and consumer awareness and communication campaigns.

Table 3-8: Action plan for Establishing Communication Plan and Consumer Awareness Campaign

Action	Lead Agency & Other Stakeholders	Timeframe
1. Develop awareness campaigns and capacity building programs on new MEPS and labelling regulations	MoEPD/ ZERA	2023
2. Conduct a training program for ZERA, MoEPD, ZIMRA and relevant government agencies staff on evaluation and revision of the MEPS and labelling requirements	International Advisor	2025
3. Conduct a training program for ZETDC on managing and maintaining On-bill/ Green on-wage financing scheme	MoEPD, ZERA, International Advisor	2024

Action	Lead Agency & Other Stakeholders	Timeframe
4. Conduct a training program for in-store salespersons on understanding energy label and educating customers on the label usage and value	MoEPD	2025
5. Implement awareness campaigns for retailers/ wholesalers/ distributors on MEPS and labelling regulations to manage inventories	MoEPD, ZERA	2025
6. Conduct regular public awareness and educational campaigns for consumers, and develop communication tools (incl. website, brochures, media reports, TV, and radio broadcasts, etc.)	MoEPD, ZERA and Consumers Association of Zimbabwe	Every year

3.4 Financing Mechanisms

3.4.1 Current Situation

Achieving energy efficiency improvements will require a significant increase in investments in energy efficiency. Considering that energy-efficient refrigerators could cost more than conventional products, the preference for purchasing residential refrigerators could be greatly impacted by customers' financial capacity, who are likely to be inclined towards the less costly refrigerators. The high consumer preference for lower prices poses a significant challenge. This is also compounded by the consumers' poor perspective on bank loan terms and conditions.

Zimbabwe's main financial institutions include CBZ, Stanbic, ZB Bank, FBC, BancABC, First Capital, NMB, NEDBANK and Agribank. The Commercial banks, the building societies, Merchant banks, and the Development banks form the banking sector. The banking sector offers equipment loans or asset finance, e.g., tractor loans to farmers by CBZ, with Government playing a facilitating role.

The loans the IDBZ offers are project finance and equity, and mortgage finance on housing projects. The Bank has a green credit line and expressed interest to finance clients' investments in energy-efficient appliances such as refrigerators, considering that the Bank is in the process of being accredited by the GCF. The Bank has been involved in a number of energy-saving projects already. The bank played an important role in the financing of the ZPC-Kariba South Power Station Expansion (300MW). The Bank also provided finance for the roll out of the ZETDC prepaid meter project. These projects are significant energy efficiency enhancements. The Bank is also involved in a number of solar projects.

It is imperative to implement financial mechanisms that facilitate end-users in the residential sector access to energy-efficient and climate-friendly residential refrigerators and provide incentives along the demand and supply chain to overcome financial and technical barriers.

3.4.2 Recommended Financing Mechanism

To scale up the adoption of energy-efficient and climate-friendly residential refrigerators, effective targeted finance strategies and financial mechanisms will be required to review,

develop, and implement. The appropriate supporting policies on financial tools that overcome vital market barriers and facilitate financing flow will help address the untapped market potential.

On the demand side, simple-to-access financial mechanisms with competitive conditions will help to motivate households to acquire high-efficient appliances that can generate substantial energy savings. Credit is vital to facilitate that end-user disburse an amount equivalent to or lower than what implies to purchase a second-hand system. On the supply side, the financing mechanisms will aim to engage and motivate providers to sell energy-efficient and climate-friendly appliances by increasing their sales volume by providing credit facilities to their clients.

The effective targeted finance strategies and financial mechanism options intend to:

- Set up green credit facilities between partner local financial institutions (e.g., banking institutions, National Development Bank (NDB), microfinance institutions, etc.) and participating EE technology providers (e.g., local retailers, local distributors, local/international manufacturers) with support from international financial institutions such as Multilateral Development Banks (MDB) or green funds to ease access to concessional finance and help overcome the higher upfront cost barrier for end-users.
- Structure low-risk repayment mechanisms between key local stakeholders such as partner financial institutions, the power utilities (the Zimbabwe Electricity Transmission and Distribution Company (ZETDC), or the employer institutions, as well as participating EE technology providers.
- Address market barriers, align with the specific country context, and leverage local opportunities to maximize both options' technical and commercial feasibility (e.g., targeting salaried employees or prepaid metering customers, building on experience with consumer finance products, etc.)

Financing Mechanism Option

Two financing schemes are recommended to implement financial mechanisms that facilitate end-users in the residential sector - Option 1: On-bill financing scheme, and Option 2: Green on-wage financing scheme.

Option 1: On-bill financing scheme- -is an innovative approach to financing energy efficiency that has proven effective for smaller investments and increasing energy-efficient equipment uptake. The model enables energy utility customers to acquire energy-efficient equipment, such as domestic refrigerators, and to pay for the equipment over time through their monthly utility bills.

The mechanism allows these households to repay green loans or credits obtained from partner financial institutions and participating vendors through the utility's post-paid or pre-paid metering systems. Operationalizing the On-bill financing mechanism requires significant support from the partner power utility (ZETDC).

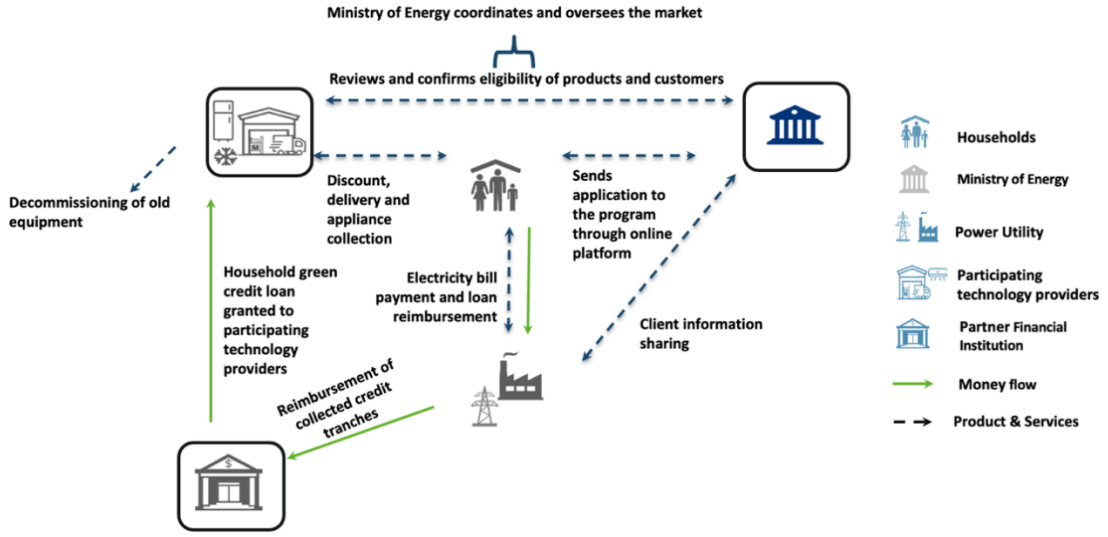

Figure 3-6: Recommended On-Bill Financing Scheme

On-bill financing can be supported by capitalizing new on-bill loan funds, through credit enhancement for existing on-bill funds, such as loan guarantees, and by positive lists. The success of the model depends mainly on the interest and engagement of the utility, which in many cases is, in part or whole, government owned. The government can support the model by capitalizing on new on-bill loan funds and providing credit enhancement for existing on-bill funds, such as loan guarantees. Governments and development agencies can play important roles by providing technical support in setting up the model or providing green credit lines.

Option 2: Green on-wage financing scheme-an innovative mechanism that offers flexible and straightforward repayment terms for energy efficiency products through salary deductions. Green on-wage financing is a consumer finance product designed to meet the short- and medium-term financing needs of salaried employees of public and private institutions that are profiled or have a business relationship with local financial institutions.

Green on-wage financing can be supported by bulk rebates negotiations, or green credit lines from international financiers to local financial institutions, to help offer the best loan features to end-consumers (e.g., low interest financing for longer tenor periods) and a viable green lending strategy. Green on-wage financing can be complementary with on-bill financing which would target both salaried and unsalaried customers from the energy utilities (ZETDC) allowing loan repayments through electricity bills instead.

- Certified appliance models supplied by participating technology providers and registered on a positive list
- Partner financial institutions in repayment agreements with profiled employers
- Partner financial institutions in finance agreements with participating technology providers

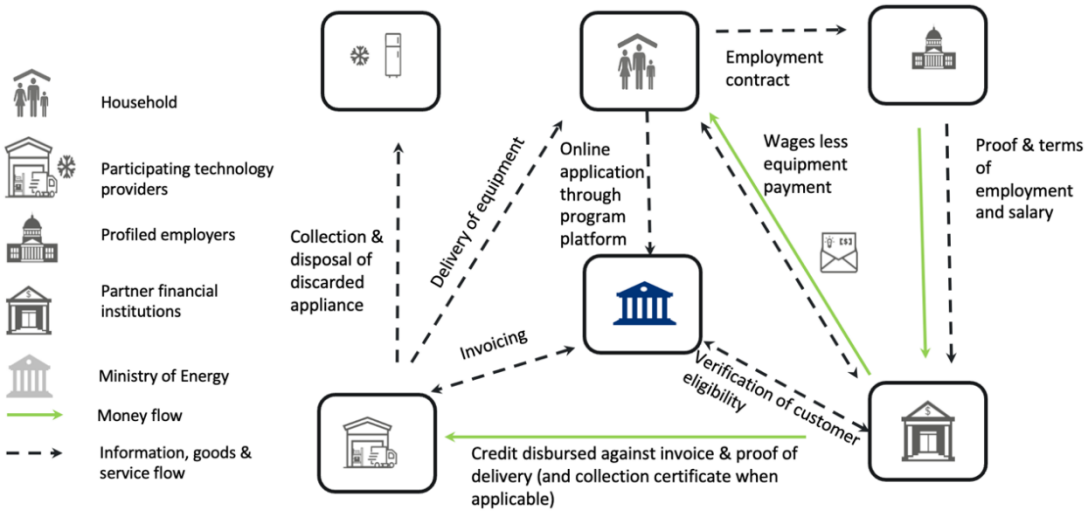

Figure 3-7: Recommended On-Wage Green Financing Scheme

Remark: Details of explanation on On-bill financing scheme and Green on-wage financing scheme can be found in ANNEX G – Financing Mechanisms for Refrigerators.

Involvement of key national stakeholders

To develop the financing strategies and financing scheme, Ministry of Energy and Power Development (MoEPD) should consult and seek the potential partnership of interested financial institutions including local financial banking or international funds, the relevant public and private agencies, and the participating EE technology providers. The following public and private stakeholders are important and must be closely involved.

- Ministry of Energy and Power Development (MoEPD) acting as the lead compliance entity/program manager
- Power Utility (ZETDC)
- Other relevant government institutions (e.g., Zimbabwe Energy Regulatory Authority (ZERA), Climate Change Management Department (CCMD), Ministry of Finance and Economic Development (MoFED), etc.)
- Partner financial institutions (e.g., banking institutions, microfinance institution, NDB, MDB, green funds, etc.)
- Partner technology providers of energy-efficient residential refrigerator (e.g., local retailers, local distributors, etc.)

3.4.3 Actions & Timeframe

Table 3-9 lists key actions for developing and implementing a supporting financial mechanism for energy-efficient residential refrigerators (See ANNEX G – Financing Mechanisms for Refrigerators).

Table 3-9: Action Plan for Establishing and Implementing Financial Mechanisms for Refrigerators

Action	Lead Agency & Other Stakeholders	Timeframe
1. Finalize financing strategies and detailed implementation plan	MoEPD leads, with support from ZERA, MECTHI, MoFED, etc.	2023
2. Engage potential donors and prepare technical assistance project proposals to turn the financial mechanism concepts (On-bill financing and/or Green on-wage financing) into programs	MoEPD	2023
3. Develop and implement the On-bill financing mechanism program and/or the Green on-wage financing mechanism program	MoEPD leads, with support from ZERA, MECTHI (take-back scheme), MoFED, and technical assistance projects supported by international donors and experts	2024
4. Design and implement marketing campaigns to promote the financing mechanisms	MoEPD and ZETDC/ financial institutions and technology providers	2024 onwards

3.5 Monitoring Verification and Enforcement

3.5.1 Current Situation

Although Zimbabwe has not established a legislative and administrative framework to address non-compliance with MEPS and labelling requirements for electrical appliances, however, Zimbabwe has a legal framework to certify compliance and inspect non-compliance with the electrical safety regulations. The current compliance and inspection activities are being carried out by the Standards Association of Zimbabwe (SAZ).

Rather than redesign a legal and administrative functions for MV&E implementation of the appliance MEPS and labelling programs, MoEPD, ZERA and SAZ will consider applying the existing regulatory framework for product safety legislation for electrical and electronic household products such as refrigerators, whether can be adapted and expanded to include additional EE regulations and standard enforcement as well as structure an MV&E scheme.

3.5.2 Recommended MV&E Component

The goal of monitoring, verification, and enforcement (MV&E) is to establish a national system and administrative functions to stimulate MV&E actions in order to accelerate a market transformation to higher energy efficiency refrigerators. MV&E includes multiple components covering the establishment of a legal and administrative framework, enforcement procedures, a plan for monitoring and market surveillance and verification testing, a plan for

communicating information and the results of compliance activities to stakeholders, and evaluation plan of program outcomes.

Table 3-10 provides a summary of MV&E components for the full implementation of MV&E actions for refrigerators in Zimbabwe.

Table 3-10: Components of MV&E for Refrigerators

MV&E Component
Establishment and operation of a national MV&E system The following aspects to be considered: • Mandatory or voluntary participation • Legislative powers and program administration • Budget and financial considerations for compliance activities • Identification of key institutions for undertaking specific actions (certification, monitoring & market surveillance) under the legislation
Establishment of a national registry system for refrigerators The following aspects to be considered: • Procedure and process of registration to ensure that the applicant provides all the information to assess whether a product meets the requirements • Identification of information that the applicant must provide • Identification of stakeholder engagement in certifying and managing product registry system
Establishment of communication program to promote compliance activities The following aspects to be considered: • Main stakeholders involved in the supply chain • Key messages – compliance requirements, the risk of detection and sanctions
Establishment of market surveillance program for refrigerators The following aspects to be considered: • Approaches to checking markets for non-compliance (e.g., risk-based and random sampling) • Procedures for applying penalties for non-compliance cases
Establishment of verification testing program for refrigerators The following aspects to be considered: • Criteria for selecting test laboratories for testing a product • Clear guidance on procurement and transport of samples to the test laboratory for verification testing • Setting up MRAs with other countries or for regional level product testing laboratories to save cost
Establishment of evaluation program for mandatory MEPS and labelling program for refrigerators

MV&E Component
The following aspects to be considered: • MEPS registration & certification process and compliance

A detailed description of MV&E can be found in ANNEX K - Monitoring, Verification, and Enforcement (MV&E).

3.5.3 Actions & Timeframe

Key actions specific to establishment and implementation of the MV&E framework such as development of a national MV&E system and administrative functions, a product registration system, market surveillance and verification testing programs for refrigerators, communication and evaluation programs are listed in Table 3-11.

Table 3-11: Key Actions specific to MV&E framework for Refrigerators

Action	Lead Agency & Other Stakeholders	Timeframe
Establishment and operation of a national MV&E system for refrigerators		
Develop a regulatory & enforcement mechanism - to address managing of compliance activities and clearly specify roles and responsibilities of related enforcement authorities on all related MV&E activities including liability measures with penalty structure for cases where non-compliance has been established	MoEPD (lead)/ SAZ/ ZERA/ ZIMRA/ MoFED	Draft by end of 2023 and full enforcement by 2024
Develop administrative procedures/ operational manual for enforcing regulations on MEPS and labelling program	MoEPD (lead)/ ZERA/ SAZ/ Customs	2023
Assess and conduct capacity building on national MV&E mechanism for responsible staff (customs and other related-MV&E officials)	MoEPD/ ZERA	2023
Establishment of a national registry system for refrigerators		
Develop a procedure and process of product registration system (PRS) for refrigerators Review U4E's prototype PRS software and consider whether to use it (in whole or part) as the basis for developing a national PRS	MoEPD/ ZERA	2024
Train responsible officers in charge of management and maintenance of PRS	MoEPD/ ZERA	2023
Develop procedures for customs personnel to monitor compliance of imported refrigerators with the import regulations for refrigerator products, listed under mandatory MEPS and labelling requirements	MoEPD (lead)/ ZERA/ ZIMRA/ MoFED/ Customs	Draft by end of 2023 and full enforcement by 2024

Action	Lead Agency & Other Stakeholders	Timeframe
Develop national regulations on mandatory registration of refrigerators	MoEPD	Draft by end of 2023 and full enforcement by 2024
Establishment of communication program to promote compliance activities for refrigerators		
Design communication plan for all the main stakeholders involved	MoEPD/ ZERA	2023
Develop information materials for custom officials and consumers	MoEPD/ ZERA	2023
Train importers on mandatory registration of regulated refrigerator products and their legal obligations	MoEPD/ ZERA	2023
Develop and publish annual reports to maintain market transparency and declare non-compliance cases	MoEPD/ ZERA/ SAZ	2023
Establishment of market surveillance program for refrigerators		
Establish a methodology for identification of products selected and purchase for verification processes, allocate staff for verification (Market Surveillance) and implement	MoEPD/ ZERA/ SAZ	Draft by the end of 2023 and full operation on annual basis by 2024
Train responsible officers in charge of market surveillance	MoEPD/ ZERA	2023
Implement pilot market surveillance program and evaluate the results for full application deployment	MoEPD/ ZERA	2024 and full operation on annual basis by 2025
Establishment of verification testing program for refrigerators		
Develop procedures for verification testing and test laboratory selection (outsourcing lab testing and/or using shared test results from neighbouring countries or other entities) to verify EE of selected products	MoEPD/ ZERA/ SAZ	2024
Implement pilot verification testing program and evaluate the results for full application deployment	MoEPD/ ZERA/ SAZ	2024 and full operation on annual basis by 2025
Establishment of evaluation program for mandatory MEPS and labelling program for refrigerators		
Plan and implement the evaluation program on MEPS registration & certification process, compliance, and impact, identify resource and implement	MoEPD/ ZERA	2025 and on an annual basis for the following years

4 Distribution Transformers

The total transmission and distribution losses for 2019 in Zimbabwe were estimated at 3.74% and 12.5% respectively, aggregating to 16.24% against a ZERA target of 12%. Some sections of the transmission and distribution (T&D) infrastructure, including cables and distribution transformers (DTs), are old and require rehabilitation, and this manifests in power outages even if the power demand is low. The two main agencies involved in construction and management of the T&D infrastructure in Zimbabwe are:

- **Zimbabwe Electricity Supply Authority (ZESA):** ZESA is a state-owned company responsible for the generation, and transmission of electricity in Zimbabwe.
- **Zimbabwe Electricity Transmission and Distribution Company (ZETDC):** ZETDT's business is the distribution and retail of electricity to the final end user.

The estimated national stock of distribution transformers is 20,000 and the annual sales are estimated at 2,000 (ZETDC, 2021). Assuming an average DT life span of 20 years gives a replacement rate of 5% per annum. In order to get annual replacements, the annual DT stocks were multiplied by the rate of 5%. Therefore, the 2021 and 2030 DT replacements at end of life were 2,011 and 4,158 respectively. The replacement rate due to theft and vandalism is 1,000 per year. A summary of DT stock, market size, market value, potential energy savings, and emissions savings in 2021, 2030 and 2040 is shown in Table 4-1.

Table 4-1: Summary of DT stock, market size, market value, potential energy savings, and emissions savings in 2021, 2030 and 2040

	2021	2030	2040
Projected sales (GWh)	16,000	33,000	66,000
Quantity of new DTs penetrating	20,215	63,165	143,965
Stock of DTS	40,000	83,165	163,965
Number of DTs replaced at end of life	2,011	4,158	8,198
Number of DTs replaced due to theft and vandalism	2,011	4,158	8,198
Total market size of DTs	24,237	71,482	160,362
Total market value of DTs (US$ million)	53	156	350

ANNEX I – Market Assessment on Distribution TransformersFigure 4-1 shows the projected transformer energy losses for three scenarios (business-as-usual, level 1 efficient transformers, and level 2 efficient transformers). As a percentage of the total distribution losses over the period 2021-2040, these losses ranged from 9% to 13% for the BAU scenario, 6% to 9% for the Level 1 scenario and 5% to 7% for the Level 2 scenario. Figure 4-2 shows the potential energy savings for the Level 1 and Level 2 scenarios and Table 4-2 summarizes the potential energy and emissions reductions.

Zimbabwe has multiple companies that manufacture and sell transformers such as ZENT, South Wales Electric, GEC, and Hawker Siddeley Engineering, and also has companies that import transformers. Those that manufacture transformers import some raw materials or transformer sub-assemblies. ZENT said it imports around 90% of the raw materials and sub-

assemblies. ZENT was introduced to the theory of amorphous core distribution transformers (AMDT) when it was manufacturing under license, and it highlighted that AMDT core losses are 70 to 80% lower than transformers with cold rolled grain-oriented steel (CRGO).

More details about the projection and DT market can be found in ANNEX I – Market Assessment on Distribution Transformers.

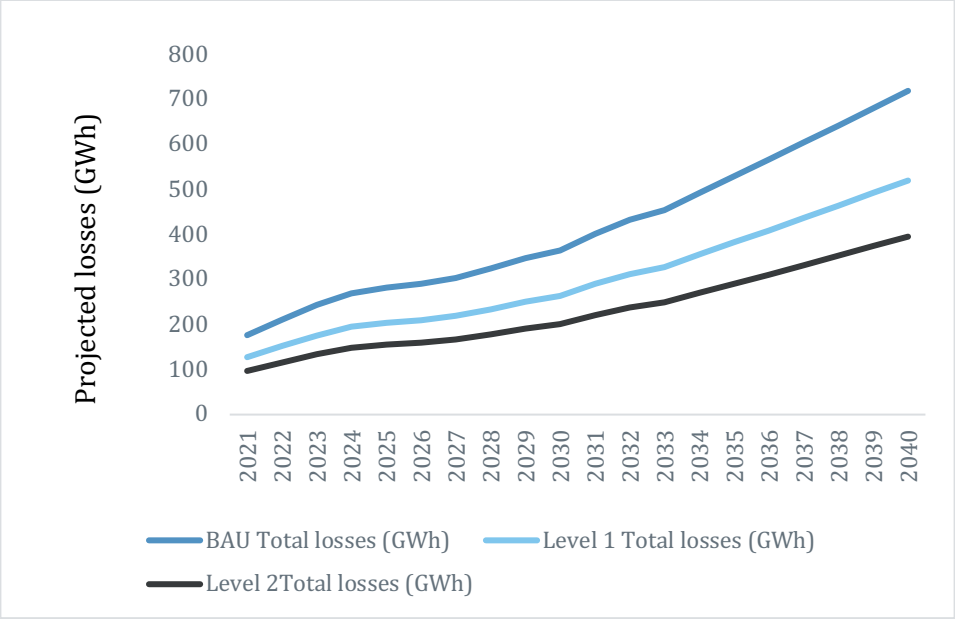

Figure 4-1: Projected energy losses under BAU, Level 1 and Level 2 scenarios

Source: Market Assessment, 2021

Table 4-2: Potential energy savings and emissions reduction

	Potential energy savings (GWh)			Potential emissions reduction (GgCO2eq)		
Scenario	2021	2030	2040	2021	2030	2040
Level 1	50	100	200	30	45	90
Level 2	80	160	320	60	70	140

Source: Market Assessment, 2021

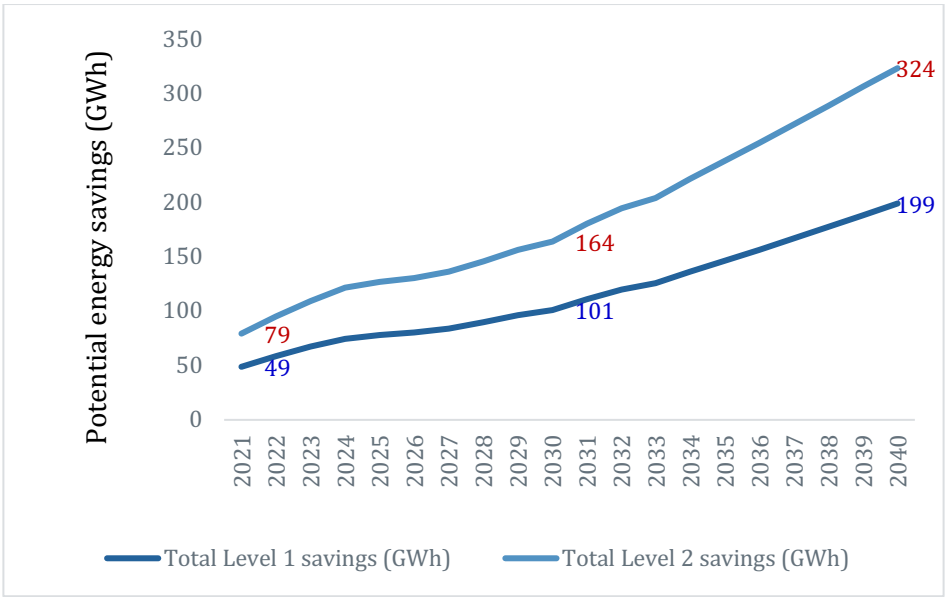

Figure 4-2: Potential energy savings under Level 1 and Level 2 scenarios

4.1 Minimum Energy Performance Standards

4.1.1 Current Situation

The Procurement Regulatory Authority of Zimbabwe (PRAZ) is a national body which is facilitating procurement policies for government, utilities, or other buyers of transformers. The utility gives its technical specifications as per the Distribution Code and the procurement is done through a tendering process. Zimbabwe has a detailed specification for distribution transformers up to 800 kVA, and the detailed specification guides the following requirements in procurements of distribution transformers:

- Tenders should advise to which standard the transformers are manufactured and tested and shall supply relevant test certificates or test results.
- The transformers shall be sourced from manufacturers who have ISO 9001 Certification. Evidence of the ISO 9001 Certification shall be provided with the bid. Manufacturers who cannot submit such certification are liable to be rejected.

Zimbabwe, through the SAZ, is a member of IEC and Zimbabwe is also guided by the World Trade Organisation (WTO)/Technical Barriers to Trade (TBT) Agreement Code of Good Practice for the Preparation, Adoption and Application of Standards. The Standards Association of Zimbabwe has adopted the following power and distribution transformer standards (SAZ, 2021):

- ZWS 191: 1976: Current transformers
- ZWS IEC 76:1998: Part 5: Ability to withstand short circuit
- COMESA ZWS HS IEC 61378: 2017: Converter transformers Part 3: Application guide
- COMESA ZWS HS IEC 60076: 2013: Power transformers Part 1: General
- ZWS IEC 60076.2:2014: Power Transformers Part 2: Temperature rise for liquid – immersed transformers

- ZWS IEC 60076.2:2014: Power Transformers Part 3: Insulation levels, dielectric tests, and external clearances in air
- ZWS IEC 60076.2:2014: Power Transformers Part 8: Application guide
- ZWS IEC 60076.2:2014: Power Transformers Part 10: Determination of noise levels
- ZWS IEC 60076.2:2014: Power Transformers Part 10-1:2017: Determination of sound levels – Application guide
- ZWS IEC 60076.2:2014: Power Transformers Part 10-14: 2014: Part 14: Liquid-immersed power transformers using high temperature insulation materials

Although SAZ has not yet adopted the IEC 60076-20 technical specification which covers comprehensively energy efficiency issues of transformers, SAZ said that the adoption of the technical specification in the future cannot be ruled out.

4.1.2 Recommended MEPS

Many countries and regions have adopted all, parts, or modified versions of IEC 60076 series - Power transformers[10] to best fit their local or regional requirements. In South Africa, SANS 60076 Parts 1 and 20 and SANS 780:2021 are used. SANS 780:2021 includes provisions for both performance testing and MEPS. As discussed earlier, DTs are mainly procured in Zimbabwe through ZETDC and REF. It should be noted that the current electric power transmission and distribution losses represent 21.8% of output in Zimbabwe. This is more than twice the losses in South Africa. As such, improving the DT energy efficiency policy and regulation is of paramount importance for Zimbabwe.

IEC 60076-20 provides methods for efficiency and efficiency index calculation with two levels of recommendations

- Level 1 is for basic energy performance
- Level 2 is for high energy performance

This standard may specify the energy performance by:

- Minimum PEI (Peak Efficiency Index)
- Maximum load losses and maximum no-load losses
- Minimum Efficiency Index at a load factor of 50%

The energy loss in DTs is highly dependent on the usage pattern as shown in Figure 4-3. however, not all energy performance indices may be able to capture this accurately. Using the 50% load method could not differentiate between the performance of 3 different designs as shown on the right of Figure 4-3. however, considering the Load and No-Load losses can capture the difference in performance under both the realistic and worst-case DT loading scenarios.

[10] https://webstore.iec.ch/publication/588

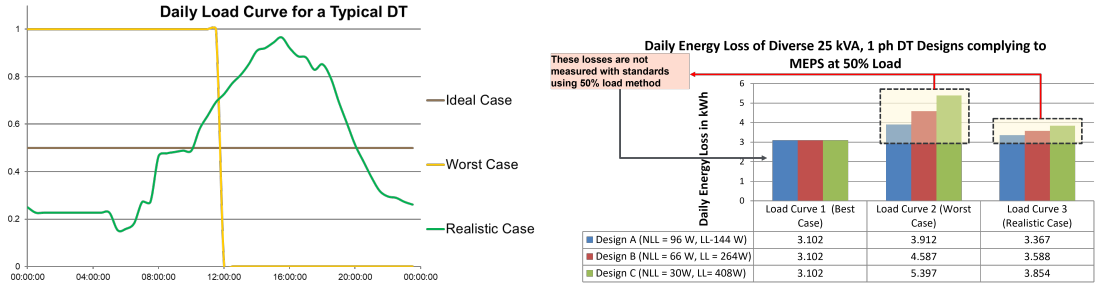

Figure 4-3: Energy loss in DTs based on usage pattern.

The performance based on Load/No-Load losses, one of the approved performance indices in IEC 60076-20, are the most appropriate and representative of typical use cases. It is also recommended by the U4E regional model regulation and is already adopted by SANS 780:2021. Considering this, it is recommended for ZETDC to adopt the maximum LL/NLL for the procurement specifications and as the criteria for factory-acceptance testing. Considering that South Africa is the major trade partner of Zimbabwe, adopting the maximum LL/NLL approach results in least market disturbance as distribution transformers. Regional coordination through the U4E regional model regulation would also rely on it.

It should be noted that the maximum LL/NLL criteria specified in SANS 780:2021 and IEC TS 60076-20 are not identical, however they are close and adoption of SANS 780:2021 in the initial phase will enable a softer EE DT market introduction in Zimbabwe and allow South African manufacturers to remain competitive. In view of this, the following phased-step approach are recommended for introduction of DT MEPS in Zimbabwe.

- **Step 1** – The Government of Zimbabwe should consider adoption of SANS 780:2021 as the initial MEPS for DTs in Zimbabwe and ZETDC to reference the maximum LL/NLL specified in SANS 780:2021 in its procurement specifications. This step would essentially move Zimbabwe closer to IEC 60076-20 Level 1 efficiency requirements. Zimbabwe may wish to also coordinate with SADC Countries to create a regional framework to improve the purchasing power and demand for manufacturers, hence sustain the supply of energy efficient DTs in the region.
- **Step 2** – This step is considered as an interim step towards higher efficiency DTs. During Step 1, the market would have evolved through the integrated policy approach (MEPS, HEPS, MV&E, stakeholder education). The maximum LL/NLL in this step could be IEC 60076-20 Level 1 or simply an average of SANS 780 standard and the IEC 60076-20 Level 2. This interim step helps to save more energy and keeps the focus in the sector on investing in reducing losses.
- **Step 3** – This provides final alignment with international best practices -IEC 60076-20 Level 2. This ensures that the country eventually transit to the international high efficiency standard and companies are given adequate time to procure new equipment and train staff. Setting this level out in the future gives the planning horizon suppliers and customers need so they are prepared.

The technical committee meeting on 9th June 2022 has agreed to the following timelines for implementation of the abovementioned steps, as summarized below.

- **Step 1** – one (1) year after adoption of MEPS or by 1st July 2023 (MEPS equivalent to SANS 780:2021)
- **Step 2** – four (4) years after adoption of MEPS or by 1st July 2026 (MEPS equivalent to IEC 60076-20 Level 1 or average values of SANS 780 standard and the IEC 60076-20 Level 2)
- **Step 3** – seven (7) years after adoption of MEPS or by 1st July 2029 (MEPS equivalent to IEC 60076-20 Level 2)

4.1.3 Actions & Timeframe

Although the Policy Working Group (PWG) members have identified that ZERA would be the most cognizant government authority to be the custodian of MEPS, the unique characteristics of the DT market in Zimbabwe has suggested that ZETDC shall also play a leading role in developing MEPS for DTs as it will be the main agency in implementing the DT MEPS. As DT MEPS levels have already been specified in regional and international standards, Table 4-3 lists actions for adoption of appropriate DT MEPS. It also includes country-specific activities that will support the future decision for ZETDC, SAZ and MoEPD to harmonize MEPS and testing methods with the SADC/EAC MEPS.

Table 4-3: Action plan for Adoption of DT MEPS in Zimbabwe

Actions	Lead Agency & Other Stakeholders	Timeframe
1. Develop an implementation plan on the national policy roadmap	ZETDC/ ZERA/ SAZ/ MoEPD/ ZIMRA/ PRAZ/ International & National advisor	2023
2. Finalise the draft MEPS for voluntary implementation	ZETDC/ ZERA/ SAZ/ MoEPD/ Relevant stakeholders	2023
3. Establish/designate the Authority (preferably ZERA) to regulate DTs	TWG and International/ national advisor	2023
4. Conduct a capacity-building program for regulated staff and other identified stakeholders (local manufacturers)	ZETDC/ ZERA/ SAZ/ MoEPD/ Local manufacturers/ International & National advisor	2024
5. Conduct public consultation on the voluntary MEPS to become mandatory	ZERA/ ZETDC/ SAZ/ MoEPD/ International & National advisor	2024
6. Develop a regulatory mechanism to enforce and implement mandatory MEPS and the testing method	MoEPD/ ZERA/ ZETDC	2025
7. Promulgate the mandatory MEPS	MoEPD/ Cabinet and Parliament	2025
8. Enforce the mandatory DTs MEPS	ZERA/ MoEPD	2026
9. Review and adjust the MEPS level based on the analysis of statistical data collected and the regional harmonisation trend	MoEPD/ ZERA/ ZETDC	2026 onwards

4.2 Energy Labelling

DTs are considered as large electrical equipment and manufactured based on orders from electric utilities and commercial and industrial clients. Endorsement and comparative energy labelling schemes can be beneficial for some commercial or industrial products, however affixing energy labels on DTs is not a common practice around the world as the product nameplates per IEC 60076-1 standard already provide information on LL and NLL. According to the U4E policy guide series on Accelerating the Global Adoption of Energy-Efficient Transformers, there are only six economies worldwide[11] implementing energy labelling programs for DTs. Considering this, an energy labelling scheme for DTs in Zimbabwe is not considered as a priority action under the proposed national policy roadmap.

4.3 Communication Program

4.3.1 Current Situation

Currently, the rural electrification authority works through a number of programs including the Increased Access to Electricity and Renewable Energy Production (IAEREP) programme aimed at increasing access to clean, reliable, and affordable energy through promotion of use of renewable energy (RE) and energy efficiency (EE) technologies.

4.3.2 Recommended Communication Plan

Once the MEPS recommendations are adopted, the public procurement guidelines for DTs must be updated. ZETDC needs to be informed about financial benefits of more stringent MEPS and updated formulas for computation of the Total Cost of Ownership (TCO) in the procurement guidelines. Although non-utility DT procurement is still small in Zimbabwe, communication, and educational programs on procurement of energy efficient DTs by public and private sector organizations should be developed and implemented for the following three major target groups for non-utility DT procurement.

- **Target Group A** includes engineers, consultants, and system design engineers. Their role is primarily to determine the specification, develop terms of reference and support the decision maker
- **Target Group B** includes decision makers, like CEO and owners
- **Target Group C** includes salespersons, distributors, and representatives. Their role is primarily to represent the efficient product effectively to the Target Group A.

Recommended communication and educational programs for the abovementioned target groups are discussed below.

Communication and Educational Program for Target Group A

This target group is responsible for equipment operation (cost and performance), and they are typically concerned with safety and reliability. Considering this, the communication and educational program objective would be to:

[11] China, India, Japan, Mexico, Republic of Korea, and USA

- Understand the energy consumption, efficiency, reliability, and cost aspects of DT.
- Create awareness of the life-cycle cost analysis (LCA) or total owning cost (TCO).
- Develop capacity on available tools.
- Understand how to lower the lifecycle cost (LCC) through improved DT reliability and the role of preventive maintenance
- Learn how to use IEC TS 60076-20 as a guideline of reference when they compare the specification and standard provided by the manufacturer

The communication and educational strategy for the Target Group A is summarized in Table 4-4.

Table 4-4: Communication and Educational Strategy for Target Group A

Message:	Tools Available:
• **What is the right transformer for you? (LCA vs. TCO)** • **What is energy loss? "Load/No-Load Losses"** • **How to keep your transformer running at a minimum Total Cost of Ownership (TCO) while ensuring reliability?**	• U4E TCO[12] • Utilities informational content • Transformer manufactures content/data • Articles in electrical engineering magazines • Articles on Engineering & Construction association magazine and its website, etc.

Communication and Educational Program for Target Group B

This target group is ultimately responsible for the strategic management and sustainability of the organization, and they are typically the final decisionmaker. They should be apprised with the economy, legislative landscape, stakeholder demands, and consumer and public relations. This group is mostly concerned with business productivity and cost reduction, reliability, and efficiency. As such the communication and educational program should focus on how to:

- Understand the DT selection could impact their organization's overall operating cost.
- Prioritise decision based on TCO
- Appreciate the energy loss from selecting lower efficiency transformer

The communication and educational strategy for the Target Group B is summarized in

[12] https://united4efficiency.org/resources/a-guide-to-using-total-cost-of-ownership-when-purchasing-distribution-transformers/

Table 4-5 listing the messages that need to be communicated and the available tools to implement these.

Table 4-5: Communication and Educational Strategy for Target Group B

Message:	Tools Available:
• **What is the right transformer for you? (LCA vs. TCO)** • **What is energy loss? "Load/No-Load Losses"** • **How to keep your transformer running at a minimum Total Cost of Ownership (TCO) while ensuring reliability?**	• Articles/content in magazines, Website, and social media • Newsgroup • Support from electrical engineers and consultants (target group A)

Communication and Educational Program for Target Group C

This target group is responsible for explaining product features, presenting, and demonstrating new products, and determining which products meet the needs of different customers. They are mostly concerned with their price offer since buyers who lack knowledge and understanding about TCO will favour least price offer. As such, the communication and educational program should focus on how to:

- Educate customers about the impact of DT efficiency on their overall operating cost.
- Convince decision makers to prioritize their selection based on TCO

The communication and educational strategy for the Target Group C is summarized in Table 4-6 listing the messages that need to be communicated and the available tools to implement these.

Table 4-6: Education strategy for target group C.

Message:	Tools Available:
• **What is the right transformer for you? (LCA vs. TCO)** • **What is energy loss? "Load/No-Load Losses"**	• U4E TCO • Incorporate energy efficiency and its impact on lifetime operation in company brochures or PowerPoint presentations. • Develop a stand-alone digital media and post on the company website, Facebook, etc.

ANNEX L – Awareness Raising and Education Campaigns further outlines international best practices.

4.3.3 Actions & Timeframe

Table 4-7 lists actions for development and implementation of communication and educational programs on DT MEPS and TCO for utility and non-utility procurements.

Table 4-7: Action Plan for Developing and Implementing Communication and Educational Program

Actions	Lead Agency & Other Stakeholders	Timeframe
1. Develop and implement an educational program on DT MEPS and TCO for utility procurements to communicate on financial benefits of more stringent MEPS and updated formulas for computation of the Total Cost of Ownership (TCO) in the procurement guidelines	ZETDC/ ZERA/ SAZ/ MoEPD/ International & National advisor	2023
2. Develop and implement an educational program on DT MEPS and TCO for non-utility procurements to communicate on financial benefits of procurement of energy efficient DTs updated formulas for computation of the Total Cost of Ownership (TCO) in non-utility applications	ZETDC/ ZERA/ SAZ/ MoEPD/ International & National advisor/ Relevant stakeholders	2024

4.4 Financing Mechanisms

4.4.1 Current Situation

The Infrastructure Bank of Zimbabwe (IDBZ) catalyses economic development through de-risking projects. IDBZ provides project finance and equity. Currently IDBZ is in the process of being accredited by the Green Climate Fund. This accreditation will open opportunities for the bank to access climate finance and technical expertise in green credit lines. The most popular product the bank offers is the Project Preparation and Development Fund (PPDF) which was established to assist projects to reach bankability. Lack of investment-ready, 'bankable' projects is a major constraint to greater investment in infrastructure projects. Therefore, the Bank's PPDF aims to de-risk projects and make them bankable. Absence of bankable projects is the major hindrance to infrastructure development. Note that procurement by ZETDC, REF and other government departments and parastatals for both replacements and network expansion are done through tendering in accordance with the Distribution Code and the Specification for Distribution Transformers up to 800 kVA.

4.4.2 Recommended Financing Mechanism

Three financing schemes are recommended to facilitate greater adoption of energy efficient DTs in the residential sector, including: 1) Option 1: ESCO Energy Performance Contracts (EPC) – Shared Savings Model; 2) Option 2: ESCO EPC – Guaranteed Savings Model; and 3) Option 3: Bulk Procurement with Total Cost of Ownership (TCO). The ESCO's Energy Performance Contracts (EPCs) enables funding of energy efficiency upgrades from cost reductions. Under an EPC arrangement for energy efficient DTs, an Energy Service Company (ESCO) implements an energy efficiency project and uses the stream of income from the cost savings to repay the project costs. The ESCO can be any of the large distribution transformers providers or manufacturers.

There are two major contracting models defining the relationships and risk allocations among the ESCO, end-users, and lender: (i) the shared savings model, and (ii) the guaranteed savings model.

Option 1: ESCO Energy Performance Contracts (EPC) – Shared Savings Model

In the shared savings model, the ESCO invests and implements the energy-efficiency DT project, and a contract is signed between the ESCO and the client to stipulate the terms, conditions, and obligations. The cost savings resulting from the energy efficiency upgrade are quantified, and for the duration of the contract a pre-determined share of this amount will be used to remunerate the ESCO. The ESCO only receives full payment if the project delivers predicated energy savings. This transfers project technical risks from the client (e.g., Power Utility, mining companies, agricultural companies, etc.) to the ESCO. The ESCO thus takes over both the performance and the customer credit risk and acquires financing. The financing can come from the ESCO's own equity or from a financial institution (e.g., local banking institutions, MDB, NDB, green funds, etc.). If a green loan is granted from a financial institution to the ESCO, conditional financing is applied including strong monitoring and reporting requirements, and the reimbursement of collected credit is done through the energy savings.

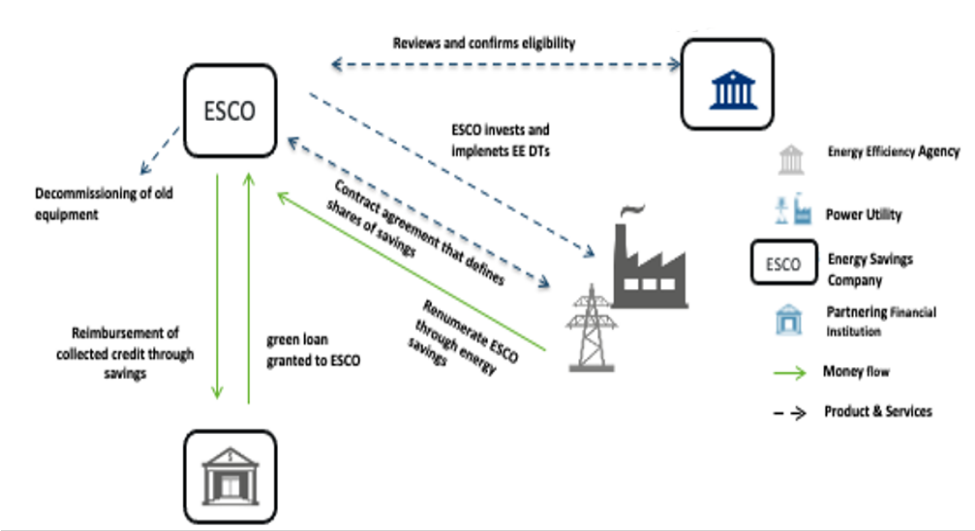

Figure 4-4: Recommended ESCO EPC - shared savings model scheme

Option 2: ESCO EPC – Guaranteed Savings Model

In the guaranteed savings model, the ESCO takes over the performance risk. The client invests and the ESCO implements (supply, installation) the EE DT investment projects. A contract is signed between the ESCO and the client to stipulate the terms, conditions, and obligations. The ESCO receives the full upfront payment (supply, installation) but guarantees a certain level of energy savings by covering, in case of underperformance, the monetary value of the difference between predicated and actual energy bill savings based on a specified utility rate. In case the energy savings are not achieved, the ESCO has to compensate the customer for the savings not achieved. This shields the customer (e.g., Power Utility, mining companies, etc.) from any performance risk. The client uses its own equity (i.e., investment project financing) or is directly financed or supported by a financial institution (e.g., MDB, NDB, green funds, banking institutions, etc.), repays the loan and assumes the investment repayment risk.

- ESCO takes over both performance risk
- Customer takes over credit risk

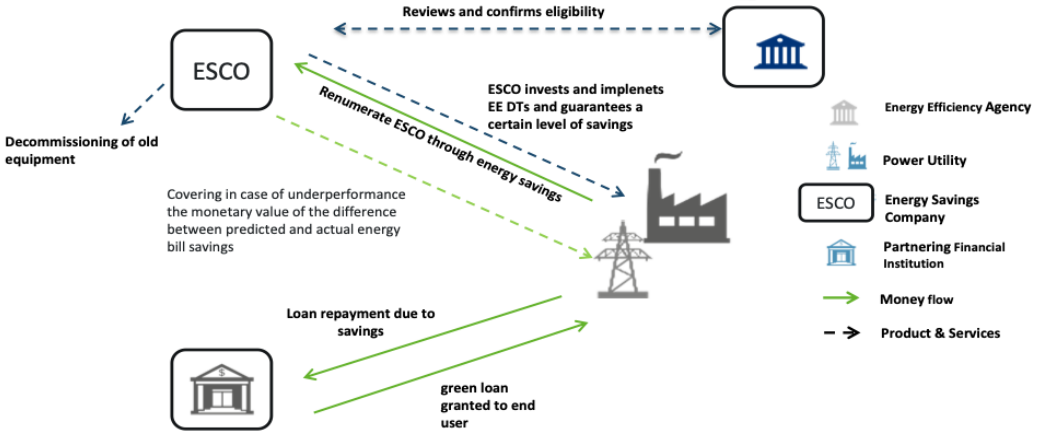

Figure 4-5: Recommended ESCO EPC - guaranteed savings model scheme

Option 3: Bulk Procurement with Total Cost of Ownership (TCO)

Bulk procurement is a no-subsidy, demand-driven mechanism that provides economies of scale, enabling manufacturers or distributors to bring down their process and costs through successive rounds of efficient and transparent bidding to create a large and sustainable market for EE DT technologies. The power utility issue tenders for itself and for all the non-utility end-users with a set of qualifying criteria including technical specifications and EE standards to buy large numbers of similar EE DT equipment, while manufacturers or distributors compete on price bids. The technical specification covers the design, manufacturing, testing, supply, delivery and performance requirements of the selected EE DT technology, and a criterion expressing maximum no-load and load losses. In each round, multiple bidders are selected and all of them are asked to match the Total Cost of Ownership (TCO) of the lowest bidder. The volume of the bid is then allocated to all the manufacturers who agree to match the lowest TCO in the bid.

Involvement of key national stakeholders

The following key national public and private stakeholders must be closely involved.

- MoEPD acting as the lead compliance entity/program manager
- Other relevant government institutions (e.g., Zimbabwe Energy Regulatory Authority (ZERA), Standards Association of Zimbabwe (SAZ), Climate Change Management Department (CCMD), Ministry of Finance and Economic Development (MoFED), Procurement Regulatory Authority of Zimbabwe (PRAZ), etc.)
- Partner ESCOs and/or participating technology providers (e.g., manufacturers and distributors of EE distribution transformers)
- Power Utility (ZETDC) and large non-utility market end-users
- Partner financial institutions (e.g., MDB, NDB, green funds, banking institutions)

4.4.3 Actions & Timeframe

Table 4-8 lists key actions for developing and implementing a supporting financial mechanism for energy-efficient DTs. More details on the supporting financial mechanism are given in ANNEX J – Recommended Detailed Implementation Plan of the financing mechanism for DTs.

Table 4-8: Action Plan for Establishing and Implementing Financial Mechanisms for DTs

Action	Lead Agency & Other Stakeholders	Timeframe
1. Establish finance/procurement strategies and detailed implementation plan for each financing mechanism	MoEPD leads, and ZETDC, ZERA, SAZ, CCMD, MoFED, PRAZ, and international/ national advisor	2023
2. Engage potential donors and prepare technical assistance project proposals for the proposed financing mechanisms	MoEPD and International/ national advisor	2023
3. Develop and implement the proposed financing mechanisms through technical assistance projects supported by international donors and experts	MoEPD leads, with support from ZETDC, ZERA, SAZ, CCMD, MoFED, PRAZ, and with technical assistance projects supported by international donors and experts.	2024
4. Seek and develop partnerships with financial Institutions and ZETDC including T&C and agreements signing for the proposed financing mechanisms	MoEPD and ZETDC/ financial institutions	2024
5. Assess eligibility and negotiate with ESCOs and/or technology providers, including MOU signing	MoEPD and ZETDC/ ESCOs/ technology providers	2024
6. Implement marketing and promotion strategy and activities to promote the pilot demonstration program(s)	MoEPD and ZETDC/ financial institutions and ESCOs/technology providers	2024 onwards

4.5 Monitoring Verification and Enforcement

4.5.1 Current Situation

Currently there is no regulatory framework for a national or regional monitoring verification and enforcement of MEPS for distribution transformers in Zimbabwe. ZENT indicated that all transformers coming into Zimbabwe are subject to testing at ZENT's testing facility.

4.5.2 Recommended Framework

Table 4-9 provides a summary of MV&E components for the full implementation of MV&E actions for DTs in Zimbabwe.

Table 4-9: Components of MV&E for Distribution Transformers

MV&E Component
Establishment and operation of a national MV&E system The following aspects to be considered: • Mandatory or voluntary participation • Legislative powers and program administration • Budget and financial considerations for compliance activities • Identification of key institutions for undertaking specific actions (certification and monitoring) under the legislation
Establishment of a national registry system for distribution transformers The following aspects to be considered: • Procedure and process of registration to ensure that the applicant provides all the information to assess whether a product meets the requirements • Identification of information that the applicant must provide • Identification of stakeholder engagement in certifying and managing product registry system
Establishment of communication program to promote compliance activities The following aspects to be considered: • Main stakeholders involved in the supply chain • Key messages – compliance requirements, the risk of detection and sanctions
Establishment of evaluation program for mandatory MEPS and labelling program for distribution transformers The following aspects to be considered: • MEPS registration & certification process and compliance

A detailed description of MV&E can be found in ANNEX K - Monitoring, Verification, and Enforcement (MV&E).

4.5.3 Actions & Timeframe

The actions and timeframe for MV&E system for DTs are summarized in Table 4-10:

Table 4-10: Key Actions specific to MV&E framework for DTs

Action	Lead Agency & Other Stakeholders	Timeframe
Establishment and operation of a national MV&E system for distribution transformers		
Develop a regulatory & enforcement mechanism - to address managing compliance activities and clearly specify roles and responsibilities of related enforcement authorities on all related MV&E activities including liability measures with a penalty structure	MoEPD/ SAZ/ ZERA/ ZETDC/ REF/ CCMD	Draft by end of 2023 and full enforcement by 2024

Action	Lead Agency & Other Stakeholders	Timeframe
Organize consultation workshops with other GCF countries and the SADC region (public utilities) to ensure alignment with national MV&E framework and harmonization of DT product registry	MoEPD/ SAZ/ ZERA/ ZETDC/ ZIMRA	2023
Develop administrative procedures/ operational manual for enforcing regulations on MEPS program	MoEPD/ ZERA/ ZETDC/ SAZ	2023
Establishment of a national registry system for distribution transformers		
Develop a product registration system (PRS) for distribution transformers	MoEPD/ ZETDC/ ZERA	2024
Train responsible officers in charge of management and maintenance of PRS	MoEPD/ ZETDC/ ZERA	2023
Develop national regulations on mandatory registration of distribution transformers	MoEPD/ ZETDC/ ZERA	Draft by end of 2023 and full enforcement by 2024
Establishment of communication program to promote compliance activities for distribution transformers		
Design communication plan for DT suppliers, customs, and other stakeholders on enforcement obligations	MoEPD/ ZERA	2023
Develop information materials on regulatory compliance requirements and obligations (e.g., procedures to obtain registrations and import permits)	MoEPD/ ZERA	2023
Develop and publish annual reports to maintain market transparency and declare non-compliance cases for manufacturers, distributors, power utilities, and end users)	MoEPD/ SAZ/ ZETDC/ ZERA	2023
Establishment of evaluation program for mandatory MEPS for distribution transformers		
Plan and implement the evaluation program on MEPS registration & certification process, compliance, and impact, identify resource and implement	MoEPD/ SAZ/ ZERA	2025 and on an annual basis for the following years

5 Overall Action Plan & Budget

5.1 Action Plan & Estimated Budget

Key actions of the national policy roadmaps for refrigerators and distribution transformers with information on lead agencies and stakeholders involved, indicative timeframe and estimated budgets are summarized in Table 5-1 and Table 5-2 respectively. It should be noted that the estimated budgets shown in the tables primarily cover costs for technical assistance as well as tools and materials required for each action. These costs are exclusive of salaries and wages of government personnel and ZETDC's staff.

5.1.1 Refrigerators

Table 5-1: Action Plan for Establishment of Enabling Policy and Regulatory Environment for Refrigerators in Zimbabwe

Action No.	Action	Lead Agency & Other Stakeholders	Timeframe	Budget (US$)
A	**MEPS**			
A.1	Develop an implementation plan on national policy roadmap	MoEPD/ ZERA/ SAZ/ ZIMRA/ International & National advisor	2023	105,600
A.2	Finalise the draft MEPS for voluntary implementation	ZERA/ SAZ	2023	35,200
A.3	Establish/designate the Authority (preferably ZERA) to regulate refrigerating appliances	MoEPD/ ZERA	2023	158,400
A.4	Develop and implement a capacity building and training program for ZERA and ZIMRA to effectively regulate the refrigerating products	MoEPD/ International Partners	2024	35,200
A.5	Conduct public consultation on the voluntary MEPS to become mandatory	Regulator (ZERA) designated to regulate the refrigerating appliances	2024	52,800

Action No.	Action	Lead Agency & Other Stakeholders	Timeframe	Budget (US$)
A.6	Develop regulatory mechanisms to enforce mandatory MEPS and testing methods	MoEPD/ ZERA/ ZIMRA	2025	105,600
A.7	Promulgate the mandatory MEPS regulation	ZERA/ MoEPD/ Cabinet and Parliament	2025	Included in A.6
A.8	Enforce the mandatory MEPS	ZERA/ MoEPD	2026	50,000
A.9	Review and adjust the MEPS level based on the analysis of statistical data collected and the regional harmonisation trend	SAZ/ ZERA/ ZIMRA	Every 5 years	52,800
B	**Energy Labelling**			
B.1	Phase 1- Conduct consultation workshops to discuss with the South African authorities and adopt the South Africa label with relevant modification on the labels.	MoEPD/ SAZ/ ZERA	2023 to 2024	35,200
B.2	Conduct market assessment to determine the initial impact of voluntary energy labelling implementation	ZERA/ SAZ/ ZIMRA	2024 to 2025	35,200
B.3	Phase 2-Develop a uniform energy performance labelling for all residential refrigerators sold in Zimbabwe. (In coordination with the mandatory MEPS regulation)	MoEPD/ SAZ/ ZERA	2025	70,400
B.4	Develop a labelling regulation on requiring all residential refrigerators imported to and sold in Zimbabwe be compliant with the mandatory labelling requirement	MoEPD/ ZERA/ SAZ/ ZIMRA	2025	70,400
C	**Communication Program**			
C.1	Develop awareness campaigns and capacity building programs on new MEPS and labelling regulations	MoEPD/ ZERA	2023	26,400
C.2	Conduct a training program for ZERA, MoEPD, ZIMRA and relevant government agencies staff on evaluation and revision of the MEPS and labelling requirements	International Advisor	2025	Included in C.1
C.3	Conduct a training program for ZETDC on managing and maintaining On-bill/ Green on-wage financing scheme	MoEPD, ZERA, International Advisor	2024	35,200

Action No.	Action	Lead Agency & Other Stakeholders	Timeframe	Budget (US$)
C.4	Conduct a training program for in-store salespersons on understanding energy label and educating customers on the label usage and value	MoEPD	2025	44,000
C.5	Implement awareness campaigns for retailers/ wholesalers/ distributors on MEPS and labelling regulations to manage inventories	MoEPD, ZERA	2025	included in C.4
C.6	Conduct regular public awareness and educational campaigns for consumers, and develop communication tools (incl. website, brochures, media reports, TV, and radio broadcasts, etc.)	MoEPD, ZERA and Consumers Association of Zimbabwe	Every year	50,000
D	**Financing Mechanisms**			
D.1	Finalize finance strategies and detailed implementation plan	MoEPD leads, with support from ZERA, MECTHI, MoFED, etc.	2023	35,200
D.2	Engage potential donors and prepare technical assistance project proposals to turn the financial mechanism concepts (On-bill financing and/or Green on-wage financing) into programs	MoEPD	2023	35,200
D.3	Develop and implement the On-bill financing mechanism program and/or the Green on-wage financing mechanism program	MoEPD leads, with support from ZERA, MECTHI (take-back scheme), MoFED, and technical assistance projects supported by international donors and experts	2024	250,000 (per mechanism)
D.4	Design and implement marketing campaigns to promote the financing mechanisms	MoEPD and ZETDC/ financial institutions and technology providers	2024 onwards	50,000
E	**Monitoring, Verification, and Enforcement**			
E.1	Develop a regulatory & enforcement mechanism - to address managing of compliance activities and clearly specify roles and	MoEPD (lead)/ SAZ/ ZERA/ ZIMRA/ MoFED	Draft by end of 2023 and full	158,400

Action No.	Action	Lead Agency & Other Stakeholders	Timeframe	Budget (US$)
	responsibilities of related enforcement authorities on all related MV&E activities including liability measures with penalty structure for cases where non-compliance has been established		enforcement by 2024	
E.2	Develop administrative procedures/ operational manual for enforcing regulations on MEPS and labelling program	MoEPD (lead)/ ZERA/ SAZ/ Customs	2023	35,200
E.3	Assess and conduct capacity building on national MV&E mechanism for responsible staff (customs and other related-MV&E officials)	MoEPD/ ZERA	2023	57,800
E.4	Develop a procedure and process of product registration system (PRS) for refrigerators	MoEPD/ ZERA	2024	65,200
E.5	Train responsible officers in charge of management and maintenance of PRS	MoEPD/ ZERA	2023	8,800
E.6	Develop procedures for customs personnel to monitor compliance of imported refrigerators with the import regulations for refrigerator products, listed under mandatory MEPS and labelling requirements	MoEPD (lead)/ ZERA/ ZIMRA/ MoFED/ Customs	Draft by end of 2023 and full enforcement by 2024	Included in E.2
E.7	Develop national regulations on mandatory registration of refrigerators	MoEPD	Draft by end of 2023 and full enforcement by 2024	Included in E.1
E.8	Design communication plan for all the main stakeholders involved	MoEPD/ ZERA	2023	17,600
E.9	Develop information materials for custom officials and consumers	MoEPD/ ZERA	2023	27,600
E.10	Train importers on mandatory registration of regulated refrigerator products and their legal obligations	MoEPD/ ZERA	2023	17,600
E.11	Develop and publish annual reports to maintain market transparency and declare non-compliance cases	MoEPD/ ZERA/ SAZ	2023	included in E.8

Action No.	Action	Lead Agency & Other Stakeholders	Timeframe	Budget (US$)
E.12	Establish a methodology for identification of products selected and purchase for verification processes, allocate staff for verification (Market Surveillance) and implement	MoEPD/ ZERA/ SAZ	Draft by the end of 2023 and full operation on annual basis by 2024	26,400
E.13	Train responsible officers in charge of market surveillance	MoEPD/ ZERA	2023	Included in E.14
E.14	Implement pilot market surveillance program and evaluate the results for full application deployment	MoEPD/ ZERA	2024 and full operation on annual basis by 2025	27,600
E.15	Develop procedures for verification testing and test laboratory selection (outsourcing lab testing and/or using shared test results from neighbouring countries or other entities) to verify EE of selected products	MoEPD/ ZERA/ SAZ	2024	Included in E.14
E.16	Implement pilot verification testing program and evaluate the results for full application deployment	MoEPD/ ZERA/ SAZ	2024 and full operation on annual basis by 2025	27,600
E.17	Plan and implement the evaluation program on MEPS registration & certification process, compliance, and impact, identify resource and implement	MoEPD/ ZERA	2025 and on an annual basis for the following years	17,600
			TOTAL	**1,820,200**

Note: The total budget is based on one financial mechanism (D.3) chosen for implementation.

5.1.2 Distribution Transformers

Table 5-2: Action Plan for Establishment of Enabling Policy and Regulatory Environment for Distribution Transformers in Zimbabwe

Action No.	Action	Lead Agency & Other Stakeholders	Timeframe	Budget (US$)
F	**MEPS**			
F.1	Develop an implementation plan on the national policy roadmap	ZETDC/ ZERA/ SAZ/ MoEPD/ ZIMRA/ PRAZ/ International & National advisor	2023	105,600
F.2	Finalise the draft MEPS for voluntary implementation	ZETDC/ ZERA/ SAZ/ MoEPD/ Relevant stakeholders	2023	35,200
F.3	Establish/designate the Authority (preferably ZERA) to regulate DTs	TWG and International/ national advisor	2023	35,200

F.4	Conduct a capacity-building program for regulated staff and other identified stakeholders (local manufacturers)
	
	Description: Budget for a capacity-building program covering all aspects of the EE policy implementation and transitioning to the regulated MEPS for local manufacturers:
	• Training needs assessment, designing training courses & material for all relevant stakeholders including organizing the training - US$105,600
	• Benchmarking activities - US$15,000
	• Selection of a technology transfer partner
	  ○ Transformer design software - US$50,000
	  ○ Training for design software - US$12,000 (4 engineers)
	  ○ Hardware and tooling for meeting MEPS - US$720,000*
	  ○ Prototype Tier 1-Tier 3 MEPS - US$120,000 (12 QTY)
	  ○ Temporary export to SA + transportation - US$21,600
	  ○ Type tests at NETFA (South Africa) - US$75,000
		ZETDC/ ZERA/ SAZ/ MoEPD/ Local manufacturers/ International & National advisor	2024	399,200*

Action No.	Action	Lead Agency & Other Stakeholders	Timeframe	Budget (US$)
	Note: *Cost for new tools and manufacturing equipment for local manufacturers is not included.			
F.5	Conduct public consultation on the voluntary MEPS to become mandatory	ZERA/ ZETDC/ SAZ/ MoEPD/ International & National advisor	2024	35,200
F.6	Develop a regulatory mechanism to enforce and implement mandatory MEPS and the testing method	MoEPD/ ZERA/ ZETDC	2025	35,200
F.7	Promulgate the mandatory MEPS	MoEPD/ Cabinet and Parliament	2025	Included in F.3
F.8	Enforce the Mandatory DTs MEPS	ZERA/ MoEPD	2026	Included in F.3
F.9	Review and adjust the MEPS level based on the analysis of statistical data collected and the regional harmonisation trend	MoEPD/ ZERA/ ZETDC	2026 onwards	17,600
G	**Communication Program**			
G.1	Develop and implement an educational program on DT MEPS and TCO for utility procurements to communicate on financial benefits of more stringent MEPS and updated formulas for computation of the Total Cost of Ownership (TCO) in the procurement guidelines	ZETDC/ ZERA/ SAZ/ MoEPD/ International & National advisor	2023	27,600
G.2	Develop and implement an educational program on DT MEPS and TCO for non-utility procurements to communicate on financial benefits of procurement of energy efficient DTs updated formulas for computation of the Total Cost of Ownership (TCO) in non-utility applications	ZETDC/ ZERA/ SAZ/ MoEPD/ International & National advisor/ Relevant stakeholders	2024	27,600
H	**Financing Mechanisms**			
H.1	Establish finance/procurement strategies and detailed implementation plan for each financing mechanism	MoEPD leads, and support from ZETDC, ZERA, SAZ, CCMD, MoFED, PRAZ, and international/ national advisor	2023	35,200

Action No.	Action	Lead Agency & Other Stakeholders	Timeframe	Budget (US$)
H.2	Engage potential donors and prepare technical assistance project proposals for the proposed financing mechanisms	MoEPD and International/ national advisor	2023	35,200
H.3	Develop and implement the proposed financing mechanisms through technical assistance projects supported by international donors and experts	MoEPD leads, with support from ZETDC, ZERA, SAZ, CCMD, MoFED, PRAZ, and with technical assistance projects supported by international donors and experts.	2024	250,000 (per mechanism)
H.4	Seek and develop partnerships with financial Institutions and ZETDC including T&C and agreements signing for the proposed financing mechanisms	MoEPD and ZETDC/ financial institutions	2024	Included in H.3
H.5	Assess eligibility and negotiate with ESCOs and/or technology providers, including MOU signing	MoEPD and ZETDC/ ESCOs/ technology providers	2024	Included in H.3
H.6	Implement marketing and promotion strategy and activities to promote the pilot demonstration program(s)	MoEPD and ZETDC/ financial institutions and ESCOs/technology providers	2024 onwards	50,000
I	**Monitoring, Verification, and Enforcement**			
I.1	Develop a regulatory & enforcement mechanism - to address managing compliance activities and clearly specify roles and responsibilities of related enforcement authorities on all related MV&E activities including liability measures with a penalty structure	MoEPD/ SAZ/ ZERA/ ZETDC/ REF/ CCMD	Draft by end of 2023 and full enforcement by 2024	158,400
I.2	Organize consultation workshops with other GCF countries and the SADC region (public utilities) to ensure alignment with national MV&E framework and harmonization of DT product registry	MoEPD/ SAZ/ ZERA/ ZETDC/ ZIMRA	2023	35,200
I.3	Develop administrative procedures/ operational manual for enforcing regulations on MEPS program	MoEPD/ ZERA/ ZETDC/ SAZ	2023	35,200

Action No.	Action	Lead Agency & Other Stakeholders	Timeframe	Budget (US$)
I.4	Develop a product registration system (PRS) for distribution transformers	MoEPD/ ZETDC/ ZERA	2024	65,200
I.5	Train responsible officers in charge of management and maintenance of PRS	MoEPD/ ZETDC/ ZERA	2023	8,800
I.6	Develop national regulations on mandatory registration of distribution transformers	MoEPD/ ZETDC/ ZERA	Draft by end of 2023 and full enforcement by 2024	Included in I.1
I.7	Design communication plan for DT suppliers, customs, and other stakeholders on enforcement obligations	MoEPD/ ZERA	2023	17,600
I.8	Develop information materials on regulatory compliance requirements and obligations (e.g., procedures to obtain registrations and import permits)	MoEPD/ ZERA	2023	27,600
I.9	Develop and publish annual reports to maintain market transparency and declare non-compliance cases for manufacturers, distributors, power utilities, and end users)	MoEPD/ SAZ/ ZETDC/ ZERA	2023	Included in I.6
I.10	Plan and implement the evaluation program on MEPS registration & certification process, compliance, and impact, identify resource and implement	MoEPD/ SAZ/ ZERA	2025 and on an annual basis for the following years	17,600
			TOTAL	**1,454,400**

Note: The total budget is based on one financial mechanism (H.3) chosen for implementation.

5.2 Revenue Streams

The revenue streams for the implementation of MEPS and energy labelling can be generated through implementation of the MV&E scheme. The possible revenues would include product registration fees and enforcement fines. The program can charge the applicants (manufacturers and importers) based on the number of models registered. A Brief description of each revenue stream is described below.

- **Product registration fees:** The regulatory authorities that administer the MEPS and energy labelling legislation can charge fees for the registration levied on the number of equipment models registered (including "families" of models). The registration fees can vary for each product type and reflect variations in production costs or energy consumption.
- **Enforcement fines:** The potential revenues from product enforcement are directly tied to the suspension or cancellation of a product's registration. If non-compliance has been detected and no proper corrective actions are undertaken, the offender will be required to pay a specified penalty. Following the penalty payment, non-compliance products will still be deregistered if the non-compliance is confirmed by the check-testing process.

6 References

UNEP/U4E: Policy guidebook for climate-friendly and energy-efficient refrigerators. Available at: https://united4efficiency.org/resources/

UNEP/U4E: Energy labelling guidance for lighting and appliances. Available at: https://united4efficiency.org/resources/

LBNL: Design of standards and labeling programs in Chile: techno-economic analysis for refrigerators. Available at: https://www.osti.gov/biblio/1171355

Compliance Counts: A Practitioner's Guidebook on Best Practice Monitoring, Verification, and Enforcement for Appliance Standards & Labeling. Available at: https://www.clasp.ngo/research/all/compliance-counts-a-practitioners-guidebook-on-best-practice-monitoring-verification-and-enforcement-for-appliance-standards-labeling-1/

7 ANNEXES

7.1 ANNEX A – Members of the Policy Work Group

	Stakeholder	Focal Point	Sex	Title
1	National Designated Entity	Munashe Mukonoweshuro	F	Climate Change Scientist, GCF National Alternate Focal Point and CTCN NDE Focal Point
2	Ministry of Environment, Climate, Tourism and Hospitality Industry (MECTHI)	Mr Washington Zhakata	M	Director- Climate Change Management Department
3	National Ozone Unit	George Chaumba	M	Project Manager
4	Ministry of Energy and Power Development	Dr. S. Ziuku	M	Director- Energy Conservation and Renewable Energy (ECRE)
		Mr B. M Mangwende	M	Deputy Director- (ECRE)
		Salome Maheya	F	Principal Energy Development Officer
		Chakanetsa Mhungira	M	Energy Development Officer
5	Zimbabwe Energy Regulatory Authority	Eng. S. Zaranyika	M	Senior Energy Efficiency Engineer
6	Ministry of Industry	Bridget Mhonderwa	F	Principal Economist
7	Ministry of Finance and Economic Development	Henry Dutiro	M	Debt Officer
8	SMEs- Ministry of Women Affairs, Community and Small-to-Medium Enterprises Development	Tariro Chipepera	F	Director
9	Zimbabwe Revenue Authority	Lillian Musarandega	F	Customs Training Officer
10	Zimbabwe National Statistics Agency (ZimStat)	Maxwell Gambiza	M	Statistical Clerk
		Michael Munapo	M	Principal Statistical Officer
11	ZESA Enterprises (ZENT)	Eng. Shepherd Madoroba,	M	Head of Manufacturing Division
		Kudzai N. Zidenga	M	General Manager
12	Zimbabwe Electricity Transmission and Distribution Company (ZETDC)	Eng. S. Musarurwa	M	Power Development Engineer
13	Rep for Procurement Specs - Procurement Regulatory Authority of Zimbabwe (PRAZ)	Mr. Cliff Gondo	M	Director Capacity Building

	Stakeholder	Focal Point	Sex	Title
14	Standards Association of Zimbabwe	Romana Marunda	M	Standards Development, Information and Training Manager
15	Private Sector Association Rep (refrigeration and cooling expert)- Imperial	Charles Jena	M	General Manager
16	Private Sector Association Rep - REAZ	Isaiah Nyakusendwa	M	Chairman
17	Bankers Association of Zimbabwe	Tillas Gopoza	M	Chief Economist
18	Zimbabwe Environmental Lawyers Association (ZELA)	Byron Zamasiya	M	Consumer Protection Association Rep
19	Harare Institute of Technology	Anthony Phiri	M	Director Environmental Management, Renewable Energy and Climate Change Center
20	Engineering Institute Representative	Dr Wilson Banda	M	Membership Services and Training Officer
21	Manufacturer/ Distributor's Representative	Passmore Chigwanda	M	Director- Primepep Services T/A Tradecom Africa
22	Manufacturer's/ Distributor's representative - Hawker Siddely Engineering	Makomborero Midzi	M	General Manager
23	Academia - University of Zimbabwe	Mr Chingosho	M	Lecturer, Cluster Leader- Energy & Power/ Rfenewable Energy Program Coordinator
24	Consumer Council of Zimbabwe	Tare R. Moyo	F	Mashonaland Region Officer
25	Zimbabwe National Chamber of Commerce	C Mugaga	M	CEO
26	Chamber of Mines	David Matyanga	M	Mining Affairs Manager
27	SACREEE	Johnson Siamachira	M	Communications Expert
		Tendayi Marowa	M	Local Policy Expert

7.2 ANNEX B – Members of the Technical Committee for Refrigerating Appliances

	Stakeholder	Focal Point	Sex	Title
1	Ministry of Energy and Power Development	Salome Maheya	F	Principal Energy Development Officer
		Chakanetsa Mhungira	M	Energy Development Officer
2	Standards Association of Zimbabwe (SAZ)	Romana Marunda	M	Standards Development, Information and Training Manager
3	National Designated Entity	Munashe Mukonoweshuro	F	Climate Change Scientist, GCF National Alternate Focal Point and CTCN NDE Focal Point
4	Zimbabwe Energy Regulatory Authority	Eng. S. Zaranyika	M	Senior Energy Efficiency Engineer
5	Ministry of Industry	Bridget Mhonderwa	F	Principal Economist
6	SMEs- Ministry of Women Affairs, Community and Small-to-Medium Enterprises Development	Tariro Chipepera	F	Director
7	Zimbabwe National Statistics Agency (ZimStat)	Michael Munapo	M	Principal Statistical Officer
8	National Ozone Unit	George Chaumba	M	Project Manager
9	Manufacturer/ Distributor's Representative	Passmore Chigwanda	M	Director- Primepep Services T/A Tradecom Africa
10	Private Sector Association Rep (refrigeration and cooling expert)- Imperial	Charles Jena	M	General Manager
11	Zimbabwe Institute of Zimbabwe (ZIE) Representative	Dr Wilson Banda	M	Membership Services and Training Officer
12	Harare Institute of Technology	Anthony Phiri	M	Director Environmental Management, Renewable Energy and Climate Change Center
13	Consumer Council of Zimbabwe	Tare R. Moyo	F	Mashonaland Region Officer
14	SACREEE	Johnson Siamachira	M	Communications Expert
		Tendayi Marowa	M	Local Policy Expert

7.3 ANNEX C – Members of the Technical Committee for Distribution Transformers

	Stakeholder	Focal Point	Sex	Title
1	Ministry of Energy and Power Development	Salome Maheya	F	Principal Energy Development Officer
		Chakanetsa Mhungira	M	Energy Development Officer
2	Standards Association of Zimbabwe (SAZ)	Romana Marunda	M	Standards Development, Information and Training Manager
3	National Designated Entity	Munashe Mukonoweshuro	F	Climate Change Scientist, GCF National Alternate Focal Point and CTCN NDE Focal Point
4	Zimbabwe Energy Regulatory Authority	Eng. S. Zaranyika	M	Senior Energy Efficiency Engineer
5	Rural Energy Fund (REF)	Patrick Dongo	M	Planning Engineer
6	ZESA Enterprises (ZENT)	Eng. Shepherd Madoroba,	M	Head of Manufacturing Division
		Kudzai N. Zidenga		General Manager
7	Zimbabwe National Statistics Agency (ZimStat)	Maxwell Gambiza	M	Statistical Clerk
8	Zimbabwe Electricity Transmission and Distribution Company (ZETDC)	Gloria Gawe	F	Research and Specifications Engineer
9	Manufacturer's/ Distributor's representative - Hawker Siddely Engineering	Makomborero Midzi	M	General Manager
10	Private Sector Association Rep- REAZ	Isaiah Nyakusendwa	M	Chairman
11	Academia- University of Zimbabwe	Mr Hilton Chingosho	M	Lecturer, Cluster Leader- Energy & Power/ Rfenewable Energy Program Coordinator
12	Chamber of Mines	David Matyanga	M	Mining Affairs Manager
13	SACREEE	Johnson Siamachira	M	Communications Expert
		Tendayi Marowa	M	Local Policy Expert

7.4 ANNEX D – Acts and Policies

Zimbabwe has a number of environmental and energy related laws and policies as well as an economic development blueprint that has direct and indirect implications on production of renewable energy.

Acts

The country's energy sector is currently governed by the following Acts:

- Electricity Act {Chapter 13:10} (2002): To establish Zimbabwe Electricity Regulatory Commission and provide its functions and management, and detail the licensing and regulation for the generation, transmission, distribution, and supply of electricity by the utility and IPPs.
- Rural Electrification Fund Act {Chapter 13: 20} (2002): To establish the Rural Electrification Fund Board for distribution of Rural Electrification Funds.
- Environmental Management Act {Chapter 20:27} (2002): To establish the National Environmental Council and Environmental Management Agency
- Petroleum Act {Chapter 13:22} (2006): To establish the Petroleum Regulatory Authority and its function and management, and licensing and regulation of the petroleum industry
- Energy Regulatory Authority Act {Chapter 13:23} (2011): To establish the Energy Regulatory Authority and provide its functions and management, and amend the provisions of Electricity Act (2002) and Petroleum Act (2006)

Policies governing the energy sector

- National Energy Policy (2012): Seeks to promote the optimal supply and utilisation of energy, for socio-economic development in a safe, sustainable, and environmentally friendly manner. It brings out Government's objective to ensure that the energy sector's potential to drive economic growth and reduce poverty is fully harnessed
- National Renewable Energy Policy (2019): The policy aims to provide energy access to all in a sustainable manner by increasing the contribution of renewables in the country's energy mix.
- Low Emission Development Strategy (2020-2050) (2019): One of the energy sector mitigation projects of the country's LEDS aims to increase energy performance of appliances leading to reduced grid power consumption.
- Zimbabwe's Nationally Determined Contribution (2021): Zimbabwe's revised NDC target is a 40% per capita emissions reduction across all sectors of the economy below the projected business as usual scenario by 2030. One of the energy sector mitigation projects is about energy efficiency improvement in various sectors of the economy.
- Zimbabwe's National Climate Change Response Strategy (2015): Seeks to establish specific provisions for dealing with climate change issues within various sectors, understanding the extent of the threat and putting in place specific actions to manage potential impacts
- Zimbabwe Climate Policy (2017): Seeks to create a pathway towards a climate resilient and low carbon development economy in which the people have enough adaptive capacity and continue to develop in harmony with the environment. The

policy is expected to mainstream climate issues in all sectors of the economy including; energy, agriculture, industrial processes, waste, land use, land cover and forestry

- The 2030 Agenda for Sustainable Development: The Goal 13 of UN Sustainable Energy for All states the need to take urgent action to combat climate change and its impacts
- Vision 2030: To transform Zimbabwe into an upper middle-income economy, raise employment levels upwards, and to progressively reduce the poverty rate to levels consistent with the upper middle-income economies, among other factors. The National Development Strategy 1: 2021-2025 (NDS1) is the 5-year Medium Term Plan aimed at realizing the country's Vision 2030, while simultaneously addressing the global aspirations of the Sustainable Development Goals and Africa Agenda 2063. The NDS1 aims to achieve an average annual real GDP growth rate of above 5% during the period 2021-2025.

7.5 ANNEX E – Energy Efficiency Implementation Ecosystem

The energy efficiency market transformation relies on 5 main pillars:

- MEPS
- Labels
- Communication - Consumer and Stakeholder Education
- Monitoring, verification, and Enforcement
- Financing

Minimum Energy Performance Standards (MEPS)

MEPS establish the minimum efficiency as a function of size or capacity of the product to allow market entry. The minimum efficiency can either be defined as the allowable energy or electricity consumption (as with the case of refrigeration appliances) or the allowable energy losses (as with the case of DTs). For refrigerating appliances; example MEPS include U4E model regulations, SANS941:2020, Ecodesign, US-DOE 10 CFR 430.32(a), and others. For DTs, example MEPS include the U4E model regulation, IEC 60076-20, SANS 780:2021.

MEPS typically rely on published standard test protocols/procedures in order to ensure fair comparison between products. For refrigerating appliances; example standard test protocols include IEC 62552-3:2015, SANS62552:2008, US-DOE 10 CFR 430, Subpart B, Appendix A and Appendix B, ASHRAE standard 72, and others. For DTs, example IEC 60076 series, SANS 780:2021, and SANS 60076 series.

MEPS generally create a “market push” and eliminate the least efficient appliances and equipment from entering the market. However, MEPS don’t necessarily encourage higher efficiency equipment.

Labels

Labels provide a mechanism for customers to understand the relative performance of the appliance or equipment against other technologies on the market. Comparative labels improve the customer awareness and demand for higher efficiency products creating a “market pull”. Labels do not necessarily eliminate the least efficient appliances and equipment from entering the market; however, they shift the market towards more efficient products.

Cost-effective implementation of MEPS and Labels may be achieved through regional harmonization (as with the regional U4E model regulation) or the adoption of international standards (as with the adoption of IEC standards or major trade partner standards).

Communication - Consumer and Stakeholder Education

Consumer and stakeholder education is an important part of the energy efficient market transformation ecosystem. They raise the awareness towards energy efficient technologies and their socioeconomic impacts. Proper consumer and stakeholder education may involve communication campaigns, capacity building activities, etc. This is an important pillar of the ecosystem as it ensures that government officials understand the value of energy efficiency and how to create the proper policies, the supply chain is well educated about the value of energy efficiency and how they can better advise and convince consumers to opt for higher

efficiency products, and that consumers understand the labels and purchase the most efficient products.

Monitoring, Verification, and Enforcement (MV&E)

Monitoring, Verification and Enforcement (MV&E) ensure policy integrity and create a level playing field where manufacturers comply with MEPS and labels, consumers receive the benefits promised by the labels, and government achieve target national impact (e.g., NDC). Monitoring is the most important step where the authority regularly surveys the market to identify potential cases of non-compliance. This if followed by a verification where the potential offense is revealed through testing or validation of the products' performance claims. Finally, the enforcement step is the last and most important step where the authority acts against the non-compliance offence. These actions should be commensurate with the offence in order to prevent any future offense from happening.

Financing Mechanisms

Achieving energy efficiency improvements will require a significant increase in global investments in energy efficiency. Much of the financing will need to be mobilised locally, and from private sources. In order to scale up the adoption of energy-efficient solutions such as energy-efficient and climate-friendly domestic refrigerators and distribution transformers, investments must be suitably enhanced with effective targeted financing strategies. This generally includes demand-side management (DSM) interventions that focus on process optimization, which achieve reductions in energy use, as well as equipment and technology interventions to ensure that the infrastructure in place is energy-efficient (e.g., purchasing energy-efficient appliances and equipment, replacing/retrofitting existing infrastructure with energy-efficient alternatives, and upgrading from old infrastructure to energy-efficient systems). In particular, effective targeted finance strategies will require the review, development, and implementation of financial mechanisms that overcome key market barriers, facilitate the flow of financing for relevant technology solutions and address the untapped market potential. When developing such strategies, it is essential to understand the technical, financial, institutional, legal, and social barriers that are constraining investments in new energy-efficient solutions

- Energy-efficient residential refrigerators:

It is imperative to implement financial mechanisms that facilitate end-users in the residential sector to have access to energy-efficient and climate-friendly residential refrigerators (including to some extent off-grid solar refrigerators) and that provide some form of incentives along the demand and supply chain to overcome financial and technology barriers.

On the demand side, simple-to-access financial mechanisms with competitive conditions will help to motivate households to acquire high-efficient appliances that can generate important energy savings. Credit is important to facilitate that end-user disburse an amount equivalent or lower to what implies to purchase a second-hand system. On the supply side, the financing mechanisms will aim to engage and motivate providers to sell energy-efficient and climate-friendly appliances (including off-grid solar refrigeration systems) by increasing their sales volume through the provision of credit facilities to their clients.

On-bill financing and green on-wage financing which are both designed specifically to promote small investment in residential refrigerators and align with the country context, targeting on-grid end-users with the possibility to extend it to off-grid end-users too.

On the one hand, the on-bill financing mechanism option enables energy utility customers to acquire energy-efficient appliances, and to pay for the equipment over time through their monthly utility bills. In many cases, on-bill programmes are designed to deliver immediate overall cost savings from the very first day without the need for the customer to invest (bill neutrality). This means that the energy cost savings equal or exceed debt service, resulting in a lower total bill (debt repayment and electricity) after retrofit.

On the other hand, the green on-wage financing mechanism option is a consumer finance product designed to meet the short- and medium-term financing needs of salaried employees of public and private institutions that are profiled or have a business relationship with local financial institutions. Green on-wage financing mechanisms option offers flexible and simple repayment terms for EE products through salary deductions.

Both options intend to:

- Set up green credit facilities to ease access to concessional finance and help overcome the higher upfront cost barrier for end-users;
- Structure low-risk repayment mechanisms between key local stakeholders such as partner banking institutions, the partner utility, or the employer institutions, as well as technology providers;
- Address market barriers, align with the specific country context, and leverage local opportunities to maximize the technical and commercial feasibility of both options (e.g., targeting salaried employees or prepaid metering customers, building on experience with consumer finance products, etc.)

- Energy-Efficient Distribution Transformers:

It is imperative to consider financial mechanisms that facilitate end-users in the commercial and public sector, to have access to energy-efficient and climate-friendly distribution transformers and that provide some form of incentives along the demand and supply chain, to overcome financial and technology barriers.

On the demand side, financial mechanisms with competitive conditions, or tools that encourage efficient utility purchasing practices such as bulk procurement with Total Cost of Ownership (TCO) and fiscal incentives, would help motivate utilities, and private sector end-users to retrofit or acquire higher-efficiency distribution transformers that can generate important energy savings. On the supply side, the mechanism options aim to engage and motivate providers to supply or install energy-efficient and climate-friendly equipment in the public and commercial sectors.

Therefore, discussions shall lead to the exploration of financing mechanisms including a combination of financial and non-financial components that are tailor-made to the country context to facilitate the access high-efficiency and climate-friendly distribution transformers for end-users, such as (i) the ESCO model's Energy Performance Contracts (EPCs) – Shared Savings model, (ii) the ESCO's EPC – Guaranteed Savings model, and (iii) Bulk procurement with TCO and fiscal incentives. All options can incentivize the utility and non-utility market players to invest in the retrofits or replacement of high technical loss or end-of-life equipment for higher-efficiency distribution transformers.

7.6 ANNEX F – Market Assessment on Refrigerating Appliances

Domestic refrigerator stakeholders in the Zimbabwean market

Institution	Description
IMPERIAL	Refrigerator manufacturer/assembler/ Importer
CAPRI	Refrigerator manufacturer
PRIMEPEP SERVICES (T/A TRADECOM AFRICA)	Importer/Distributor/ Wholesaler
TV Sales & Home	Importer/Retailer
OK Mart	Distributor
Mahomed Mussa	Distributor
Standards Association of Zimbabwe	National Standards Body
National Ozone Unit	A Unit within the Climate Change Management Department
ZimStat	National Statistics Office
Zimbabwe Electricity Transmission and Distribution Company (ZETDC)	Utility's EE and DSM
Zimbabwe Energy Regulatory Authority (ZERA)	Energy Regulator
Ministry of Industry and Commerce	Ministry
Small to Medium Enterprises Development	Ministry of Women Affairs, Community, Small-to-Medium Enterprises Development
Ministry of Local Government and Public Works	Ministry
Ministry of Finance and Economic Development	Ministry
Urban Councils Association of Zimbabwe (UCAZ)	Residents Association
Zimbabwe Environmental Lawyers Association	Lawyers Association
Infrastructure Development Bank of Zimbabwe (IDBZ)	Financial institution
ZB Bank	Financial institution
NEDBANK	Financial institution
Zimbabwe Revenue Authority (ZIMRA)	Customs

Refrigerator supply chain for Zimbabwe

The refrigerator supply chain in Zimbabwe is shown in Figure 7.1. It indicates how the manufacturers, importers, wholesalers, retailers, and consumers are linked. Capri and Imperial are the major manufactures of refrigerators in the country, while PrimePep Services (T/A Tradecom Africa), Mahomed Mussa, TV Sales & Home and OK Mart are the major wholesalers/retailers.

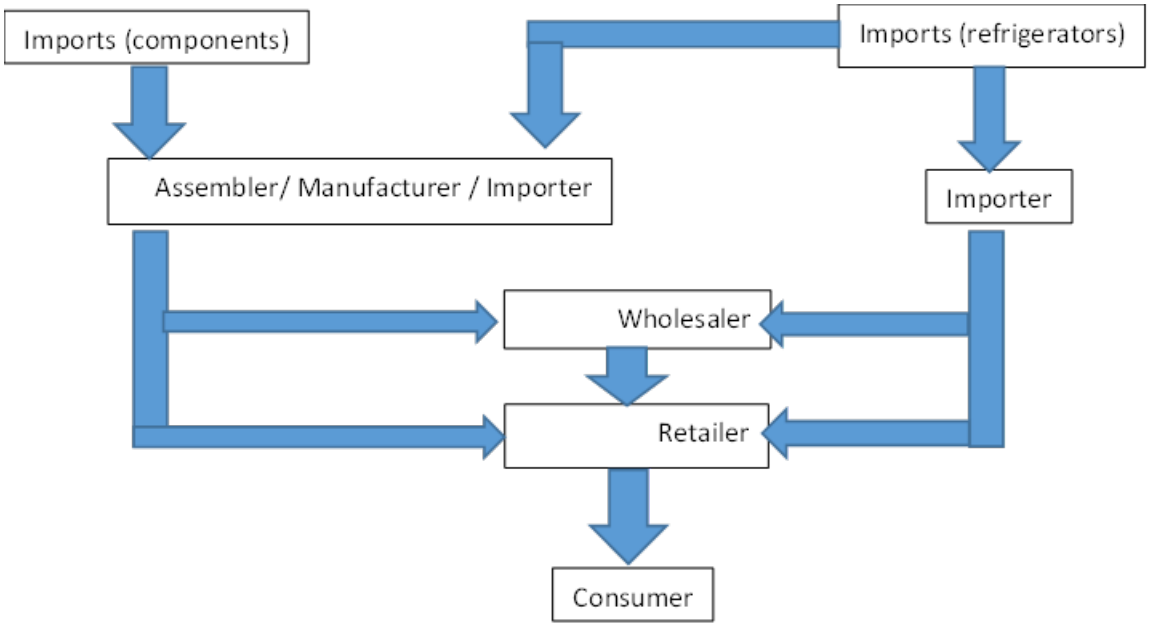

Figure 7.1: Refrigerator supply chain for Zimbabwe

Source: Market Assessment, 2021

Zimbabwe's refrigerator market landscape

The estimated annual residential refrigerator sales or market size for 2020 was between 20,000 to 35,000. Imperial focuses more on commercial refrigerators while Capri focuses on residential refrigerators. Non-inverter refrigerators have a market share of 90%. Additional insights were drawn from the market assessment as follows:

- Freezers are the largest market share.
- Direct-cool technology has more than 50% of the market share of the refrigerators and refrigerator-freezers while only 43% of the freezers were direct cool and the rest frost-free type.
- The 150-275 L range had the highest sales for all refrigerator categories.
-

Refrigerator prices ranged from USD350 for the 150 L refrigerators to around USD1,400 for the 600 L refrigerators.

Manufacturers and distributors suggest that R134a was the most widely used refrigerant during the period 2010-2015, and deployment of R600a increasingly grew during the period 2015-2020, especially in the imported brands.

The regulations governing the imports of refrigerators and other Cooling, Heating Ventilation and Air Conditioning are contained in SI 131 of 2016. Section 4 of the SI says that no person shall import into Zimbabwe, any substances listed and equipment or appliance which uses or whose function relies on the substances listed in the Second Schedule. Listed in the schedule is R12 (dichlodifluoromethane) which is used in some of the old refrigerators. The ozone-friendly refrigerants R134a – which has a high GWP and R600a– which has a lower GPW - are listed as Controlled substances (greenhouse gases) under the Fourth Schedule.

Training on the ozone friendly and low GWP refrigerants has been and is being provided to various stakeholders including immigration officials, manufacturers, refrigerant distributors, and service technicians in the country. The major obstacles on access to such refrigerants by the manufacturers is the foreign currency required to import them.

Barriers to the sale of efficient residential refrigerators

The suppliers of residential refrigerators indicated that they appreciate the importance of manufacturing more efficient refrigerators and using refrigerants that neither destroy the ozone layer nor cause global warning, as a way of building comparative advantage. However, they are concerned with the low level of awareness of these benefits by the prospective buyers of their refrigerators. They are also of the opinion that Government should have in its ministries and departments technical people who would have a better understanding of technology and energy efficiency issues and help the nation transition towards more energy-efficient appliances including residential refrigerators as they would be better positioned to inform policy.

Manufacturers of refrigerators highlighted the lack of technical skills in the industry in the future as they are unable to recruit apprentices because of low business. The graduates from the universities will not have the required skills as students face challenges in getting places for attachment during their training. If not addressed, this can be a barrier to development or adoption of more energy efficient technologies

Ownership of refrigerating equipment

Figure 7.2 shows that the refrigerants that are in most of the refrigerators studied are R134a and R600a, which contributed 57% and 37% respectively. R12 contributed 6%. The penetration of the more environmentally friendly refrigerant R600a is slow in Zimbabwe as the refrigerant was used in only 8% of the locally manufactured refrigerators. The survey results also show that the country still has a significant number of refrigerators with the banned refrigerant R12.

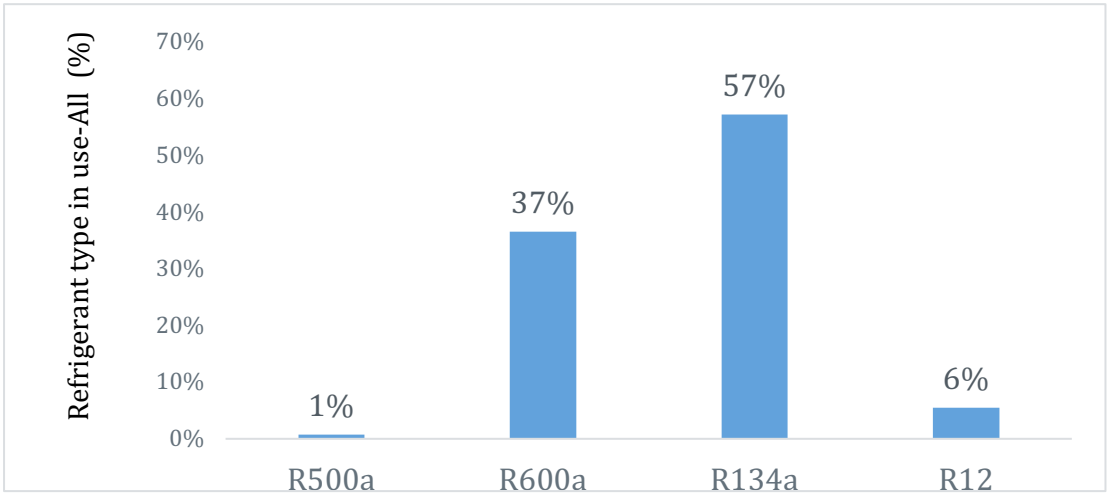

Figure 7.2: Refrigerants in both locally made and imported refrigerators

Source: Market Assessment, 2021

The level of energy efficiency standards and labelling for the locally manufactured refrigerators are lower than that of the imported ones. The percentages of the energy

efficiency-rated refrigerators were 35% for the sample, 33% for the locally manufactured refrigerator, and 48% for the imported refrigerators.

Current expenditure on electricity

Zimbabwe has been installing prepayment meters for the domestic consumers as a way of improving revenue collection as well as of promoting energy savings. Around 71% of the households spend less than US$35 on electricity per month, while 26% spend between US$36 and US$70 per month as shown in Figure 7.3. The market assessment showed that close to 95% of the households are on a prepayment system while about 5% are on a credit system, while the national statistics indicate that around 81% were on a prepayment system and 19% were on a credit system in 2019.

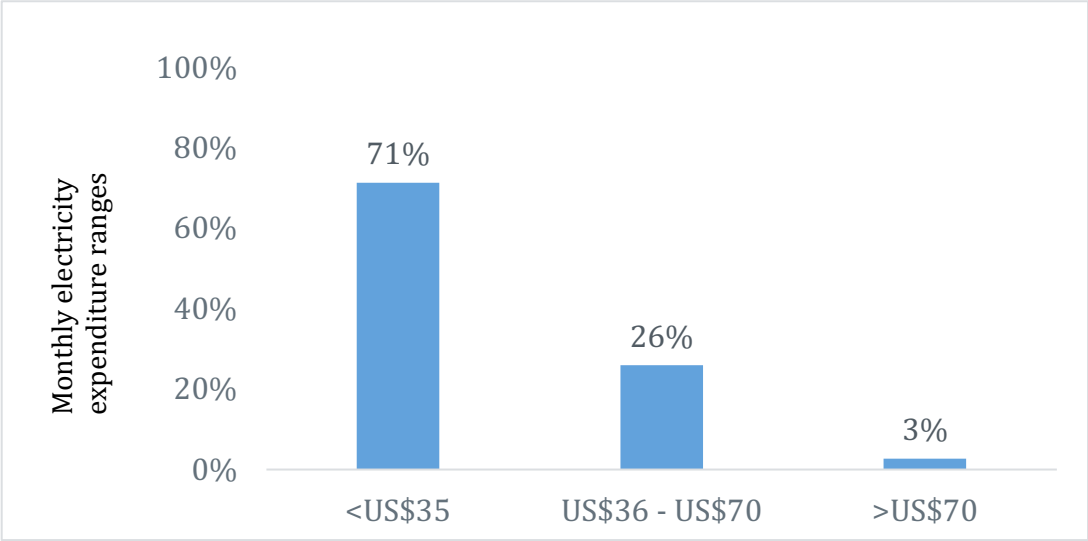

Figure 7.3: Monthly electricity expenditure ranges

Source: Market Assessment, 2021

Policies and programme landscape

Currently, the refrigeration equipment policies in Zimbabwe focuses on chemicals and electronic waste as shown below. This section further discusses financial programs and how to embed national refrigerator market in the regional context.

Prohibited substances and equipment

The regulations governing the imports of refrigerators and other Cooling, Heating Ventilation and Air Conditioning (CHVAC) are contained in SI 131 of 2016 (Environmental Management (Prohibition and Control of Ozone Depleting Substances, Greenhouse Gases, Ozone Depleting Substances and Greenhouse Gases Dependent Equipment) Regulations, 2016). The Government of Zimbabwe is in the process of reviewing the regulations (Ozone Office, 2021). These regulations apply to private and public industrial and commercial importers, exporters, producers and consumers of ozone depleting substances and greenhouse gases listed by the government

All importers, exporters or consumers of ozone depleting substances, greenhouse gases, ozone depleting substances dependent equipment and greenhouse gas dependent equipment shall ensure that such products are clearly labelled and packaged to national and international standards. The labels must state clearly, among other things, chemical formulae,

chemical name, safety measures, names and addresses of manufacturers, instructions for use and disposal, United Nations number, Chemical Abstract Service numbers and any other relevant information such as “ozone friendly”, “climate friendly”, “global warming”, or “ozone depleting”.

Status of electronic-waste management

In Zimbabwe, there is fragile interest in electronic waste management. Both ignorance and lack of interest has affected the attention to electronic waste management. Health practitioners and environmentalists have expressed little interest in tackling this issue and this has resulted in little knowledge among the public on the dangers of electronic waste in Zimbabwe. Despite its risk to human health, discourse in electronic waste risk features very little in health, environmental management, as well as disaster management strategic plans.

Zimbabwe has no legislation or policy on electronic waste management. The available Environmental Waste Management Act (20:27) only prohibits the discharge of hazardous substances into the environment, but there is no specific legislation regulating electronic waste. Various factors compound the situation of e-waste management in Zimbabwe. Apart from the absence of a legislation regulating the management of e-waste, recycling of e-waste is almost entirely left to the informal sector, which does not have adequate means to handle either the increasing quantities or certain processes leading to intolerable risk for human health and the environment. Furthermore, there are no companies investing in electronic waste recycling as a business in Zimbabwe. More so, electronic waste recycling business is hardly talked about in Zimbabwe by both the media and the environmentalists, health practitioners, and in business forum.

However, SI 131 of 2016 says:

- Authorised persons to repair, service, handle, install and decommission ozone depleting substances, greenhouse gases, ozone depleting substances dependent equipment and greenhouse gas dependent equipment
- No person shall repair, service, handle, install or decommission an ozone depleting substance, greenhouse gas, ozone depleting substance dependent equipment and greenhouse gas dependent equipment unless he or she has been trained and certified to do any such activity by the National Ozone Office, in accordance with the National Standard on certification.
- Retailers, sellers and distributors of ozone depleting substances and greenhouse gases, shall not sell such substances to any person unless he or she has been trained and certified in the handling of such substances by the National Ozone Office.

7.7 ANNEX G – Financing Mechanisms for Refrigerators

7.7.1 On-bill financing

The model

In many cases, on-bill programmes are designed to deliver immediate overall cost savings from the very first day without the need for the customer to invest (bill neutrality). This means that the energy cost savings equal or exceed debt service, resulting in a lower total bill (debt repayment and electricity) after retrofit. Through on-bill financing, utility customers can purchase efficient equipment with their regular technology provider, who facilitates the credit request. There are several ways to structure on-bill financing models:

- In one approach, the utility incurs the capital cost of the energy efficiency upgrade, which is repaid through the utility. The utility thereby effectively takes on the role of a financing entity in addition to selling electricity.
- Another approach, sometimes referred to as "on-bill repayment", the upfront capital is provided by a third party, typically public or private financial institutions, rather than the utility. The utility acts as a repayment conduit, collecting the payments through the electricity bills for the original lenders.
- It is also possible to tie the cost recovery for an efficiency investment to the property's meter rather than the property owner, which means that tariffs remain in force regardless of a change in occupancy. These tariff-based on-bill models allow customers to make investments that may outlive their residency at the property, in which case the next owner can either repay the equipment in full or continue with monthly on-bill payments

Benefits

The biggest customer benefits of this model are the avoided upfront capital expenditure, and the ease of repayment. This can help motivate investments that may not otherwise happen. The model can also enable access to finance for customers who are not able to qualify for traditional financing options by broadening customer eligibility. Indeed, on-bill financing models tend to have low default rates. This is and because the loan has bill neutrality, as well as due to people's tendency to prioritise the payment of their utility bills and, where allowed the utility's ability to shut off service in the event of non-payment.

The increased energy efficiency on the demand side benefits utilities from the avoided cost and risks of additional building of power plants, new power lines, substations, and transformers. Energy efficiency can also reduce a utility's cost of complying with major national or international environmental rules. In some cases, the on-bill mechanism is a good opportunity for utilities to make inroads into financial services benefiting from their secured clients-base who are already making frequent payments for their utility services.

Risks and challenges

The main risks and challenges to establish an on-bill financing mechanism are:

- Engaging the utility to support the transition towards energy efficiency and/ or to serve as a financier.
- Evaluating credit risk of customers through their historical electricity consumption and payments.

- Changing the utilities data and information management system to allow for on-bill repayment.
- Customer risk of power shut-off. This can be mitigated by enabling customers to obtain assistance with complaints, raise legitimate issues related to the loan
- and the project funded by the loan, and access to a dispute-resolution process.
- Managing the contractor network who might misinform the clients.
- Repayment allocation (i.e., whether utility or lender is paid first) can be an issue when customers partially pay their bills.

Recommended key components:

1. Green loans and on-bill financing as a low-risk repayment mechanism

Zimbabwe's banking system is competitive. Most of the banking institutions, as well as few microfinance institutions, offer consumer loans or credit facility, which are sought after by households to acquire movable equipment and appliances. In particular, consumer loans are intended more for employees who have a guarantee through the domiciliation of their remuneration, while the other applicants must present a guarantee acceptable to the banking institutions (collaterals). The terms and conditions differ from one institution to another. Consumer loans and credit facilities mainly target employed individuals or homeowners, who can more easily provide sufficient credit capacity or some collaterals, reducing the perception of risk for local financial institutions (LFIs), but limiting the attractiveness of such a product for self-employed or non-salaried households.

Therefore, the recommendation is to seek partnerships with one or two key local financial institutions in terms of number of retail customers, and if possible, existing partnerships with technology providers (i.e., distributors, retailers), and climate initiatives. Then build on the existing offer of consumer loans, credit facilities (e.g., employer guaranteed loan) in place and adapt the existing agreements and processes in place to comply with robust monitoring, reporting, and verification (MRV) measures to collect data on emissions, mitigation actions and support. Green loans and credits will be specifically dedicated to finance certified energy-efficient and climate-friendly residential refrigerators (including some off-grid refrigerator products) for households through the mechanism.

Through these green loans or credit facilities, the burden of up-front cost is reduced for households wishing to acquire a new appliance. Coupled with a positive list of certified appliances and partner technology providers, and a simple repayment recovery mechanism such as through household electricity consumption, the perceived default risk is much lower for partner local financial institutions wishing to favour green investment in the residential sector, while households face a simplified credit application procedure, providing them with more liquidity and reducing their borrowing costs.

Through the operationalisation and pilot of the financing mechanism, partner local financial institutions will be able to quickly build a green loan portfolio with support from external donors such as National Development Banks (NDBs), Multilateral Development Banks (MDBs), etc. Indeed, local financial institutions might benefit from de-risking instruments (i.e., credit

guarantees) and green credit lines, access to revolving loans funds, grants, or technical assistance, which will enable partners to offer concessional on-lending to end-users (i.e., longer tenor periods, lower interest rates) who invest in eligible energy-efficient assets in the residential sector. This will boost the visibility and uptake of the mechanism in the market. In return, the financing mechanisms will fast-track the disbursement of existing green credit lines provided by MDBs or other donors. In a first phase, the operationalisation and initial piloting of the mechanism will target on-lending to specific low-risk high-return market segments of the population (e.g., on-grid urban households and micro entrepreneurs). Once partner local financial institutions are comfortable with the risk level of their green loan portfolio, the mechanism will then be eventually expanded to other eligible climate technologies (e.g., off-grid solar refrigerators, SHS, etc.) and target market segments (e.g., rural communities, off-grid rural households, and micro entrepreneurs) who are generally perceived as having a higher risk profile and lower credit capacity.

2. Eligibility assessment and bulk rebate negotiations with technology providers

Through the mechanism, technology providers first apply for participation in the mechanism and their appliances must comply with the policy framework and beyond to be promoted and sold through the mechanism. The government (e.g., Ministry of Energy, etc.) and/or any non-commercial institutions certify the residential refrigerator technologies (i.e., brand models) submitted for review by the technology providers that are willing to supply new energy-efficient and climate-friendly residential refrigerators in the market through the mechanism. Technology provider applicants and their products must comply with a list of commercial and technical eligibility criteria set by the entity playing the compliance role in the mechanism. Eligibility criteria may include type of products, age of products, product size, refrigerants, GWP and ODP limits of foam blowing agents, minimum warranty, safety certification, energy efficiency (higher than MEPS), eligible brands, production duration, price, etc. The scope of the criteria can be broadened to include energy-efficient and climate-friendly off-grid solar refrigerator technologies too.

Once the brand models of residential refrigerators are deemed eligible, bulk rebates are negotiated with the eligible retailers or distributors of complying technologies. After successful negotiations are concluded, they have to agree and sign terms and conditions for participation in the mechanism, as well as finance agreements with each partner local financial institution to themselves become partners of the programme enabling the sales and promotion of certified energy-efficient residential refrigeration through on-bill financing. This might come with financing or de-risking support (i.e., green credit lines, revolving loans funds, credit guarantees) from MDBs and credit recovery from the relevant partner utility. The aim of the partnership with the technology providers is not to procure the products but to negotiate with distributors and retailers a minimum percentage rebate on the sale of each certified brand model through the mechanism. Part of the rebate is used to lower interest rates and increase tenor periods offered by partner banking institutions to consumers through credit facilities and another to incentivise consumers and offer vouchers or cash-back in exchange for the collection and disposal of end-of-life appliances through the programme. The benefit for the partner distributors and retailers is that the programme will aggregate demand for premium brand models and offer support to significantly increase the sales in

energy-efficient and climate-friendly refrigeration technologies (which are difficult to sell due to upfront cost and competition with inefficient equipment) through facilitating access to credit to the certified products. If sufficient, the rebate is also used to cover the costs related to collection and disposal of the end-of-life equipment that is turned-in by households in alignment with e-waste management regulations in the country. Bulk rebate negotiations with providers are a practice that was proved successful in Ghana, Rwanda, and Senegal to facilitate access to energy efficient cooling appliances to households through ECOFRIDGES and the Rwanda Cooling Finance Initiative.

3. Marketing and Promotion of qualifying residential refrigerators

There is the need to implement a marketing and promotion strategy to showcase the energy-efficient and environmentally friendly residential refrigerators that are deemed eligible for the programme, explain the financing options and economic benefits to households, and connect partner stakeholders with customers. It is recommended that the promotion strategy is coordinated by partners (local financial institutions, technology providers, utility), with some advisory support and guidance from institutions which are playing the main compliance role and providing key support in the mechanism to provide credibility and international visibility. It is important to show in the market that partners that are part of the programme have a distinction from the compliance entities and they belong to a group of trusted partners financing and offering energy-efficient and environmentally friendly domestic refrigerators. This will help build trust in the mechanism and products.

4. Positive list

It is necessary to build partnerships with at least one banking or microfinance institution to provide consumer loans or credit facilities to acquire new energy-efficient and climate-friendly refrigeration systems. However, at the moment, consumer loan products and credit facilities that are offered by banking institutions are used by households to finance any kind of products (including inefficient equipment) without much restriction. Therefore, it is important that the programme generates a list of certified brand models of domestic refrigerators that are certified and sold by partner distributors and retailers. Only these certified brand models registered on a positive list are eligible for financing through the mechanism. The list should be aligned with criteria that increases ambition in terms of energy-efficiency and lower global warming potential refrigerants, such as through the United for Efficiency Model Regulations. Also known as a qualified product list or positive list, it is informed by eligibility criteria for products to qualify to participate in the programme that is prepared by the main compliance entity (e.g., Ministry of Energy, etc), refined based on inputs from local experts in the country, and endorsed by partners. The positive list can be easily updated with new certified brand models and technologies (e.g., off-grid solar refrigerators, solar water heater, lighting, rooftop solar PV, air conditioning, etc.) as the programme goes.

5. Monitoring, Reporting, and Verification (MRV)

Partners have to comply with the terms and conditions (T&C) for participation in the mechanism including robust MRV guidelines and monitoring and evaluation of customer

applications for participation. MRV guidelines are used to estimate the Greenhouse Gas (GHG) emissions impacts attributable to the sales of certified models in lieu of a typical unit in the market, and a set of result indicators. MRV activities focus for instance on tracking GHG emission reductions, funding mobilization, and target co-benefits, which are directly related to the intended impact of the project. The general methodologies, key indicators that will be tracked, as well as the data collection methodologies and responsibilities will be detailed in the guidelines. The findings will be used in reporting to financiers and donors, for communications and outreach, and to help evaluate progress on an ongoing basis.

Also, providers of certified products would have to submit a conformity assessment report that would be checked by the main compliance entity (e.g., MOE etc.). A subset of these products would undergo random sample testing to verify claims in the conformity assessment report.

It is recommended that partner banking institutions and technology providers adapt and eventually integrate their information management systems to monitor and report on the financing and sales or certified brand models through the mechanism closely with the utility, which manages the credit recovery mechanism.

6. Collection and disposal

A requirement for sales of the energy-efficient and environmentally friendly domestic refrigerators and access to green loans and credit facilities should be conditioned on the turn-in, collection, and disposal of end-of-life refrigerating appliances. This includes agreements with partner providers and local financial institutions may include a clause that the household can only access the rebate if an end-of-life equipment is turned in, collected, and disposed properly. Two approaches are proposed for efficient collection and disposal; a) the procedure in place that is used by partner providers to deliver and install the new equipment can also be used to collect and dispose of the old equipment. The partner provider in charge of delivering the new equipment would then pay a small payment (coming from the agreed rebate) to cover the costs associated with the disposal to eligible e-waste management companies. In the absence of delivery and installation services from partner providers, eligible e-waste management companies are used to collect and dispose of end-of-life equipment against a commercial transaction. The e-waste management company benefits from a payment coming from the rebate. In both cases, the end-of-life equipment is sent to any existing e-waste management facility where potentially harmful gases can be disposed of in a safe and environmentally friendly manner.

Figure 7.4: Financial and non-financial components of on-bill financing mechanism

Recommended On-bill financing scheme

On-bill financing is a low-risk high-feasibility repayment mechanism. It aims to create a win-win situation for the government, households, the utility, partner local financial institutions, and partner technology providers with potential support from GCF, CTCN, NDBs, MDBs, or others.

On the demand side:

- Households wishing to take advantage of the attractive conditions of the programme announce themselves with a partner provider or a partner financial institution submitting an application to acquire an eligible equipment on credit to a partner banking or microfinance institution, in exchange of an agreement to reimburse credit through their electricity bill with the utility.
- Households, customers of the utility then refund their credits on their electricity bill for post-paid customers or pre-paid meters for prepaid customers. On-bill financing through prepayment metering systems is easier to implement than through post payment metering systems, due to the greater effectiveness and flexibility of prepayment information management systems, lower reputational risk, and regulatory costs for the utility. Indeed, the utility does not have to interrupt electricity service when facing non-repayments from prepaid customers if credit repayments are prioritised over electricity consumption in the prepayment metering systems of eligible customers.
- While the utility reimburses on a regular basis partner local financial institutions with whom it has entered into an agreement for its customers.
- The utility thus guarantees the repayment of household loans by enabling the linkage between electricity consumption and loan repayments, which make it easier for

households to obtain a green loan at preferential conditions and reduce the need to provide additional collaterals or loan guarantees for households.

On the supply side:

- On-bill financing will address the risks associated with the lack of trust in reliability of different technologies and contracts, by encouraging partner providers of certified brand models to provide and install energy-efficient at lower costs through cost effective support mechanisms
- On the one hand, the use of a positive list directs households to the formal market and thus ensures that the technologies acquired will provide consistent and high-quality results in terms of energy savings, in line with the programme.
- Moreover, following bulk rebate negotiations with distributors and retailers of certified brand models, partners will commit to indirectly reducing the sale price of certified energy-efficient and climate-friendly appliances eligible for the programme through vouchers or cash-back and concessional green credit conditions enabling payment in instalments with partner banking or microfinance institutions.
- Distributors or retailers of eligible domestic refrigerator technologies based on the set of product eligibility criteria voluntarily apply to enter into the list of partners and gain access to the demand generated by the financing mechanism.
- Partner distributors and retailers benefit from the sale, installation, and maintenance of certified energy-efficient and environmentally friendly equipment.

On-bill financing mechanism is a unique solution that can be used by partner technology providers to promote and sell certified highly efficient and climate-friendly appliances as well as by partner financial institutions seeking to provide green loans to households for the purchase of products generating significant energy savings and climate benefits. The partner utility and MOE act as facilitators and intermediaries of choice, through coordination and market surveillance, implementing and strengthening their positions as key actors in energy efficiency in the country. They promote certified systems and partners and are also able to refer potential household customers to partners. On-bill financing will increase the supply of green credit to support energy efficiency in the residential sector, greatly facilitate access to efficient and climate-friendly domestic refrigerating appliances, open access to new markets for technology providers and will promote the modernization of the utility as the electricity provider company of the future through this national energy efficiency programme. The following financial structure is recommended based on the market assessment.

On-bill financing is a low-risk mechanism supported by modern technology. Adapting the existing consumer loans or credit facilities to make it accessible to a larger number of households requires adapting and simplifying the conditions for allocating loan or granting credit, by unlinking them from the condition of domiciliation of household income. Indeed, a simple and effective solution is to rethink the recovery mechanism for the loan repayments and link repayments to household prepayment metering systems instead, in order to broaden the outreach of the programme. This offers a similar or improved management of risks for the partner local financial institutions. The mechanism combines various complementary financial and non-financial components and offers a simple credit recovery mechanism.

On-bill financing is an innovative mechanism that proves very effective for smaller investments and is therefore ideal for households who are customers of the partner utility

and wish to replace their domestic refrigerating appliances for new energy-efficient and climate-friendly ones. The mechanism allows these households to repay green loans or credits obtained from partner financial institutions and vendors through their prepaid metering systems with the utility.

Targeting prepaid metering increases the feasibility, management, and efficiency of operationalising the mechanism for the utility and adapting the repayment interface for households, increasing the incentives for households to make repayments on due date. Indeed, households tend to always prioritize their electricity consumption payments because they do not want their access to electricity to be ceased. The linkage between electricity consumption and credit repayments thus lowers default as the credit repayment is prioritised over the electricity consumption payments in the prepaid metering systems.

Operationalisation of the on-bill financing mechanism requires significant support from the partner power utility. Among other things, the utility adapts its information management system and prepaid metering system. In return, the partner utility switches from being a simple electricity provider to a provider of electricity and financial services and also has the opportunity to control the electricity consumption of its customers through this energy efficiency initiative, reducing country peak demand and savings on very expensive investments in avoided additional generation capacity. In the preferred approach, the partner utility does not provide financing itself, but is supported by partner local financial institutions, which provide green consumer loans or credit facilities with partner technology providers to households through on-bill financing. The loan is not registered on the utility, and it does not bear the default risk. The partner utility is not directly responsible to assess the creditworthiness of beneficiaries but help partner banks by leveraging data on electricity consumption and payments from customer applicants. Partner technology providers and banking or microfinance institutions are the main interface with the beneficiaries. Indeed, the partner local financial institutions provide the financing and assess credit risks for beneficiaries and on-lend to them according to set terms. The partner power utility in return collects the payments through the purchase of electricity, where a portion is sent back to the partner local financial institution to pay back the credit. Customer applicants are in agreement to share customer data with partner local financial institutions and reimburse credit through their prepaid metering system with the utility. Approved customers then pay for electricity consumption including contractually agreed deductions from the prepaid metering system. The partner utility collects credit repayments of loans on behalf of the partner local financial institutions and returns these payments to the partner financial institutions monthly.

Simplified customer application and credit risk evaluation. An utility customer wishing to benefit from the mechanism simply gets a pro forma invoice from a partner providers selling certified brand models and submits an application to a partner local financial institution, which verifies the eligibility of the household by directly or indirectly consulting the partner utility's applicant customer data (e.g. customer names, contract number, metering number, phone number, email address, electricity consumption history, payment transaction history, etc.) combined with the partner's standard credit data from the applicant. Due to confidentiality and data privacy considerations, it might be recommended that the partner utility directly leverages the applicant's customer data in its management information system to evaluate the applicant's credit risk using a simple algorithm combining history of customer

data. Doing so, the utility does not have to share the detailed customer data, but instead shares an aggregated credit rating for each applicant customer with the partner local financial institutions.

Semi-integrated systems between the partner utility and partner local financial institutions are recommended. The utility's customers refund their electricity credits through their prepaid metering systems while the utility, on a regular basis, reimburses partner local financial institutions with which it has entered into repayment agreement for its customers. In order to achieve this, there needs to be either systems integration for an online process or a paper-based approach. It is recommended that the lead compliance or implementing entities develop and manage the interface between the customers and the programme with support from the utility, partner technology providers, and local financial institutions for increased system integration. This takes the form of an online shop for customers wishing to apply for the programme.

Regarding credit recovery, it is recommended that partner local financial institutions and the utility follow semi-automated processes rather than fully automated processes to avoid further development related costs. When the utility's customers are approved for a credit from a partner banking institution, a list of names is shared by email with specific information on allocated credit that the utility needs to recover on an agreed frequency. This can also potentially be done by logging into the utility's system and uploading the file with the list on the utility server. After getting approved credit customers into the utility's system, the credit recovery is then automatic. Precisely, once contacted by a partner banking institution, the partner utility fetches for approved customers in its database one by one or adds a file of approved customer names by the partner banking institution and the system connects it automatically. Partner banking institutions can gain limited access to the utility's system in which they input all the required credit information allocated for each approved customer. Then, the utility's system carries the information into the prepaid metering payment system.

When it comes to the customer's bill repayments and credit recovery on behalf of the partner bank, the partner utility shall confirm bill repayment transactions and credit recovery to partner banks are feasible and can be accommodated. The partner utility shall also confirm that customers are attached to a single metering system. The tracking of customer credit would be feasible because credit repayments are linked with a single customer account identification in the utility's system. The utility's systems might allow various types of customer payments for electricity bills including credit recovery. For instance, customers can either pay by a number of instalments or by a percentage amount charged to a specific meter, in accordance with the type of meter in place. Customers can easily identify the number of instalments or percentage amount charged that is needed to pay back the credit. Nevertheless, to add an extra layer of control, it is recommended that the draft loan agreement with the partner local financial institutions for approved customers clearly stipulates terms, conditions, and obligations, when it comes to loan repayments. To mitigate the risks where landlords might not notify new tenants that an ongoing credit is linked to the new meter or tenants who might not notify a change of address, it is recommended that the utility provides a notification to metering customers warning tenants that there is a « credit outstanding of a certain value of money » on the meter. The utility shall confirm whether it is

technically possible to flag this directly on the prepaid meter or to send SMS/email notifications to new tenants.

Digitisation of customer application process and MRV into an online shop is recommended. The development of an online shop including smart customer interface and customer application embedding credit risk evaluation tool is recommended to lower the entry barriers for interested households and administrative costs for partners. In this case, the application process is done through an online shop where the household selects the desired certified brand model and submits the application directly online. Partners' information management systems are fully integrated, while processes are fully automated. Such a centralised digital solution also facilitates the monitoring, reporting and evaluation as well as MRV of the programme.

Recommended involvement of key national stakeholders

The following public and private stakeholders are important and are recommended to be closely involved.

- **Ministry of Energy (MoEPD). The** support from the government is essential for the success of the on-bill financing mechanism option in the country. MOE can play a key compliance role in the development and implementation of the mechanism, coordination with public stakeholders, facilitating access to the programme to new partners and technologies, promoting certified domestic refrigeration equipment and partners, and directing households towards the programme. MOE can be central in coordinating and regulating the market and thus offers quality control to households and different stakeholders involved in the proposed financial mechanism when it comes to monitoring, reporting and verification as well.
- **Partner utility.** The partner power utility plays a central role in on-bill financing by collecting credit repayments from customers in their respective regions. It must adapt, set up, manage, and maintain the credit recovery mechanism. By supporting the programme, it helps reducing the peak electricity consumption of its customers and thus avoiding the costs associated with running costly additional generation capacity during peak load and the construction of future additional power plants which would require expensive investments.
- **Partner financial institutions.** The partner local banking or microfinance institutions play a key role in developing, implementing, financing, and promoting the mechanism. Partner local financial institutions adapt their offering of consumer credits to propose green credits, while NDBs, MDBs or GCF might eventually support them with green credit lines, revolving loans funds, or credit guarantees to help mitigate any credit risk and improve concessional lending terms to households. Other key donors such as CTCN could provide technical assistance to promote and develop key components of the mechanism, as well as streamline and digitalise the system integration and processes. MDBs and GCF can advise partner local financial institutions and structure products to reduce their risks and improve their credit terms by eventually offering concessional green credit lines or credit guarantees to finance or de-risk energy efficiency investments starting with energy-efficient and climate-friendly domestic refrigerators and providing technical assistance to support the promotion and marketing, as well as the operationalisation and digitisation of the mechanism.

- **Partner technology providers of energy-efficient domestic refrigerators.** In order to implement the on-bill financing mechanism option to accelerate the adoption of energy-efficient domestic refrigeration equipment, providers must be involved from the beginning as they will play an important role in supplying the market and serve as technical experts. In the proposed on-bill financing mechanism, they are the main interface of the programme, allowing the interested household to consult a catalogue of certified and eligible equipment and get a pro forma invoice and credit application material to be then submitted to partner banking institutions and co-verified by the partner utility and the lead compliance entities such as MOE. Once a customer is declared approved, a partner provider of certified brand model will dispatch and install the household equipment on credit and eventually collect the turned-in end-of-life equipment into any eligible e-waste management facilities for disposal. As the mechanism is being scaled-up to other market segments, technology providers of off-grid solar refrigerator technologies might be invited to join the programme.
- **Households and micro entrepreneurs.** The principal beneficiaries of the proposed mechanism, on the demand side, are households including micro entrepreneurs that must be customers of the partner utility and thus connected to the grid. Households have been involved from the beginning and engaged through surveys to ensure that the programme corresponds to their preferences and expectations. Credit and participation conditions to the proposed financial mechanism must be easily accessible, concessional, and transparent, while the application process must be as simple and efficient as possible. Advantages of the programme should be explained through target communications and awareness campaigns. Although the market assessment has already shown findings about households' preferences and expectations, households should be informed continuously on the financial mechanism progress and be invited to provide feedback directly when possible.

7.7.2 Green on-wage financing

The model

First, local financial institutions enter into consumer finance agreements with technology providers and set up credit facilities. Parties agree on a rebate scheme of the amount of a minimum set percentage of the selling price of the selected products sold by the technology providers to qualified customers. Local financial institutions use the rebate received from technology providers to cover the financier's cost of funding to offer short- and medium-term unsecured consumer loans with 0 % interest rate, usually with tenor periods up to 12 months, to qualified salaried employees. This typically supports small investments of up to US$ 1500 corresponding to the sales of energy-efficient and climate-friendly systems.

Once a qualified salaried employee has successfully lodged a customer application with the selected technology provider and received in return a pro forma invoice, the customer can proceed with the credit application directly with the selected local financial institution. Once approved, the financier is able to credit the account of the technology provider with the amount corresponding to the sales price of the selected product minus the rebate almost immediately from the receipt of the proof of delivery of the selected product.

In some instances, a take-back scheme can be integrated into the green on-wage financing scheme where technology providers agree to cover both the amount of minimum percentage of the selling price of the product to be accorded to the customers in the form of a voucher or cash-back for future purchases and to contracted compliant e-waste management companies to cover the costs of collection, transport, treatment, and disposal of returned end-of-life eligible appliances. In this case, local financial institutions shall also receive a collection certificate from technology providers to proceed with the disbursement of credit.

Finally, consumer loan repayments are directly made from the customers to the local financial institutions and are either guaranteed by their profiled employers or deducted directly from the employees' after-tax salaries. There are different ways to structure the repayments:

- Employees of profiled employers who hold accounts with local financial institutions make repayments through their checking accounts at the end of each month. In the case of default, employers guarantee the repayments. In this case, the balance of due repayments is directly deducted from the salaries. Same conditions apply if the salaried employees leave the employers earlier than expected.
- Employees who hold accounts with local financial institutions agree to make direct reimbursements through salary deductions at the end of each month.
- Employers make the salary deductions for each employee and make a bulk reimbursement for all their employees to the local financial institutions at the end of each month.

The success of the model depends mostly on the interest and engagement of the local financial institutions and their number of existing profiled employer institutions.

Governments and development agencies can play important roles by providing technical support in setting up the model and ensuring compliance once operationalized.

Benefits

The biggest customer benefits of this model are the avoided upfront capital costs, and the ease of repayment. This can help motivate investments that may not otherwise happen. Access to credit is facilitated and the loan terms offered by local financial institutions are more attractive for end-customers due to rebate negotiations with participating technology providers who wish to promote and sell certified premium appliances through the mechanism. In addition, the establishment of both robust and certified monitoring and reporting of customer applications, as well as measurement, reporting and verification (MRV) processes allows local financial institutions to align with the principles of green finance through the mechanism. Additionally, take-back schemes for proper collection, transport, treatment, and disposal of discarded appliances can also be included, increasing both the incentives and co-benefits of this scheme.

Green on-wage financing facilitates the creation of a pipeline for sustainable energy investment, improves the monitoring and reporting of green loans and sales of energy products, significantly eases access to sustainable energy solutions, tackles the issues of collection and disposal of used products, and opens access to new green markets for partners.

Risks and challenges

- Engaging a committed and neutral institutional entity that is willing to support the transition towards sustainable energy and play a lead compliance role in green on-wage in order to ensure quality and durability of the scheme in the market. This includes the on-boarding of additional participating local financial institutions and vendors, the certification and registration of sustainable energy products sold through the scheme on a positive list, as well as the tracking and measurement of robust co-benefits of the mechanism.
- Aligning market expectations with the environmental goals of the scheme by negotiating an ambitious but fair percentage of rebates from participating vendors to support key components of green on-wage such as enabling preferential financing from local financial institutions, providing incentives to end-users to return discarded appliances, and supporting the costs of collection and disposal of these, while letting market forces play the main role.
- Building on existing business relationships and agreements between local financial institutions and profiled employer institutions limiting the highest potential market share of the scheme and requesting as many participating local financial institutions as possible in the scheme to maximize its outreach. Green on-wage financing recommendations

Recommended key components:

1. Green loans and green on-wage financing as a low-risk repayment mechanism

An option is to use bank loans to employees to finance the new energy-efficient and climate-friendly domestic refrigeration systems. The mechanism is well-known in the country and there are existing partnerships between banking and microfinance institutions and employers in the country as well, including with government institutions and private companies, to finance employees through salary deductions. The employee loan will both target customers who are government's employee and private sector employees. The former target group

being perceived as almost credit risk-free by financial institutions due to their employer's strong backing. Both, the burden of upfront investment and the need for collateral are hence removed or reduced, providing more liquidity, and reducing borrowing costs for customers, while drastically reducing perceived risk for financial institutions. Local financial institutions in the country offer employee loans with repayment periods extending over a few years. Banking or microfinance institutions might be able to charge below market rates monthly to employees due to lower default risk. Employees' debt burden ratio must be between a certain maximum percentage ratio of net monthly income. Loans are normally between a minimal and a maximum amount in local currency.

2. Bulk rebate negotiation with technology providers

Bulk rebates are negotiated for specific products with the providers in exchange for including their energy-efficient domestic refrigeration products in the programme. With green on-wage financing, both on-grid and off-grid solar refrigerator technologies can be targeted. The aim is not to procure products but to facilitate the entry and sales of energy-efficient products into the market. The benefit for the provider is that the green on-wage financing option will offer them support to significantly increase their sales in energy-efficient systems which are difficult to sell due to competition with inefficient equipment, through facilitating access to credit to their products.

Bulk rebates are expected to be negotiated with providers (distributors, retailers, and eventually brand manufacturers). These rebates are expected to cover the following expenses:

- A reduction in the interest rate charged by partner local financial institutions;
- A voucher gift or cash-back to end-users in exchange of turned-in end-of-life appliances (optional) and;
- To cover costs related to the collection, disposal, and treatment of turned-in end-of-life systems (optional).

A reduction in interest rate offered by partner local financial institutions is of great interest to end users as it reduces costs related to the purchase of highly efficient and environmentally friendly but relatively expensive refrigerating appliances. For instance, an interest rate of 0% serves as a powerful motivational tool to convince end-users to replace their old inefficient equipment. Purchasing a new appliance with a credit facility of 0% gives end-users the feeling of acquiring a new product without bearing upfront fee costs and without any extra charges such as interest rate.

In the process of selecting partner retailers and distributors and arriving at a finance agreement, it is important to understand the estimated margin of the retailer, the likely rebates which the brands may extend. Trade margins are estimated as follows:

- Averagely, a retailer's margin can be estimated at 35% if appliances are purchased directly from a local distributor
- Averagely, a distributor's margin can be estimated at 15%

- If the distributor is also the retailer, it can be estimated that the retail margin is around 45%

Different scenarios are available based on the relationship between the distributor and retailer (e.g., the retailer is the distributor, the retailer is supported by a minimum percentage margin by the distributor, retailers are not supported). Technology providers acting as both distributors and retailers or retailers that are supported by their distributors are identified as the highest potential target partner technology providers in the market in the country.

It is worth noting that some local financial institutions might have experience in negotiating with partner technology providers for rebates to enable them to provide consumer loans through wage deductions at concessional rates. Rebates obtained are thus usually used to cover for interest rate income loss.

3. Promotion of qualifying products

There is a need to implement a marketing and promotion strategy to showcase the energy-efficient and climate-friendly products (and eventually off-grid solar PV refrigerators) that are deemed eligible for the mechanism, to explain the financing options and economic benefits to households, and to connect partner technology providers and banking and microfinance institutions with customers. It is recommended that the marketing and promotion strategy is coordinated by the lead compliance entity or implementing agency (e.g., MOE) supported by NDBs, MDBs, GCF, CTCN to provide credibility and resources, and closely aligned with partner retailers, distributors, and local financial institutions. It is important to show in the market that the partners that are part of the programme have a distinction from the government and supporting partners and that they belong to a special group of partners offering and financing highly efficient and environmentally friendly products.

4. Positive List

It would be required to build partnerships with the banking and microfinance institutions to provide credit to customers for new energy-efficient systems. Employee loan through wage deduction or consumer finance products that might be currently offered by local financial institutions are used by households to finance any kind of products (including inefficient equipment), so it is important to generate a list of certified products and partner providers that are certified by lead compliance entity (e.g., MOE) for the programme. Also known as a qualified product list or positive list, it is informed by eligibility criteria for products to qualify to participate in the programme that would be prepared by the lead compliance entity, refined based on input from local experts in the country, and endorsed by the government. Eligibility criteria can include off-grid refrigerator technologies and distributors.

5. Monitoring, Reporting, and Verification (MRV)

Partners have to comply with the terms and conditions (T&C) for participation in the mechanism including robust MRV guidelines and monitoring and evaluation of customer applications for participation. MRV guidelines are used to estimate the Greenhouse Gas (GHG) emissions impacts attributable to the sales of certified models in lieu of a typical unit in the

market, and a set of result indicators. MRV activities focus for instance on tracking GHG emission reductions, funding mobilization, and target co-benefits, which are directly related to the intended impact of the project. The general methodologies, key indicators that will be tracked, as well as the data collection methodologies and responsibilities are detailed in the guidelines. The findings will be used in reporting to financiers and donors, for communications and outreach, and to help evaluate progress on an ongoing basis. Also, providers of certified products would have to submit a conformity assessment report that would be checked by the main compliance entity (e.g., MOE) or implementation agency and institutional partners or donors (e.g., NDBs, MDBs, GCF, CTCN, etc). A subset of these products would undergo random sample testing to verify claims in the conformity assessment report. It is recommended that partner banking institutions and technology providers adapt and eventually integrate their information management systems into a programme managed online MRV platform to better monitor and report on the financing and sales or certified brand models through the mechanism closely with the compliance entity.

6. Collection and disposal of old systems

It is estimated that for less than US$ 25, an e-waste management company could be engaged to collect used appliances and to dispose of refrigerant gases in an environmentally and safe manner based on past experiences on the African continent. Those US$ 25 represents roughly 2-6% of the total cost of a new energy-efficient appliances ranging from US$ 400 to US$ 1500. End-users are to bear costs related to the collection and disposal of old systems; however, and in order to reduce financial burdens on households and to make the programme even more attractive to households, it is envisaged to shift this burden on partner retailers and distributors. Thus, costs related to collection and disposal of end-of-life systems are negotiated within the bulk rebate (i.e., 2-6%).

In addition, gift vouchers or cash-back might serve two different purposes. From one side, it provides a further incentive to end-users to replace their old inefficient domestic refrigerating appliance with an energy-efficient and environmentally friendly product. Voucher or cash back are tangible tools that end-users can receive upon the collection of their end-of-life appliance which they can exchange in the future against any other product at their discretion. On the other hand, gift vouchers will serve as a tool to incentivize technology providers to engage in the programme as it gives them the opportunity to build up stronger relationships with customers, to increase their sales and thus their revenues through selling other equipment and appliances to targeted users. It is not clear whether gift vouchers or cashback are a common practice used in the country, whether it is used by many providers; and whether it is widely accepted and appreciated by households though.

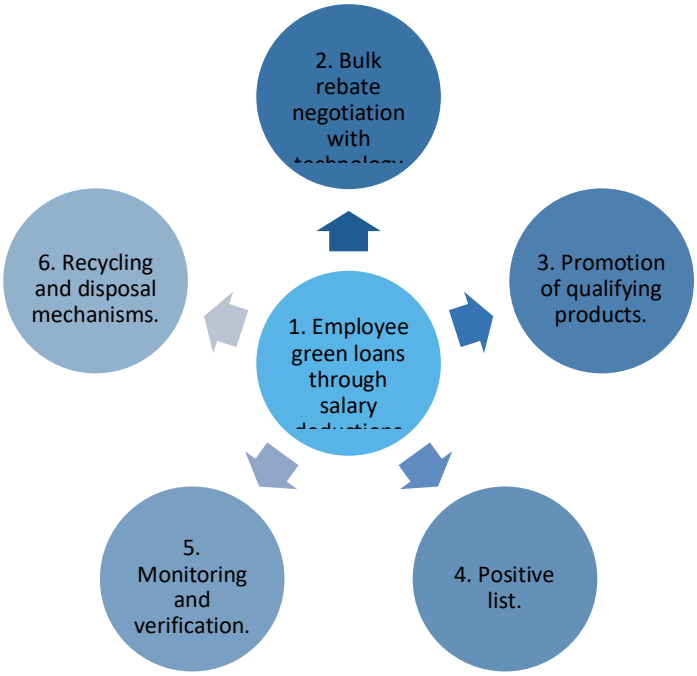

Figure 7.5: Financial and non-financial components of green on-wage financing

Recommended Green on-wage financing scheme

The green on-wage financing mechanism including all these financial and non-financial components would solve a major hurdle for targeted low-risk segments of the urban household population in the country since access to finance was identified as a barrier in the market assessment. As a consequence, green on-wage financing can help lower household energy consumption, boost household welfare, increase household disposable income, while reducing the informal market and formal market for inefficient appliances and transforming the primary market for energy-efficient and climate-friendly residential refrigerators and off-grid solar refrigerators. Green on-wage financing shows high scalability potential as it can be easily extended to more partners and more energy-efficient and climate-friendly systems such as off-grid products or other type of energy-efficient appliances throughout its development, its implementation, and beyond, to enable further upgrading of equipment and decreasing of energy consumption in the residential sector in the country. Once the mechanism is robust and visible in the market and that partner local financial institutions are comfortable with managing the risk, higher-risk segments of the population (e.g., rural, off-grid, self-employed, etc.) can be then targeted with updated financing products.

On the demand side, partner local financial institutions can provide loans to end-users as long as they are salaried and can provide the necessary implicit guarantee from their employer that their salaries can cover loan payments and that the employer will transfer part of or full salary to the financial institution throughout the loan period of time. An additional interesting option for the country is to have the financing provided by a partner financial institution indirectly to eligible clients through their employer entity. In that case, the financial institution enters into an employee green loan finance agreement with the profiled client's employer entity. The salaried customer makes loan repayments through wage deductions while his/her

employer entity makes bulk repayments for all their employees to the financial institution at the end of every month. The employer entity is thus guarantor of the client's loan, reducing the need for stringent credit assessment and collaterals. The client thus receives a green loan from the partner financial institution and buys the equipment upfront from the partner technology supplier based on a positive list of certified cooling technologies and partner technology providers pre-approved for lending. The certified cooling systems are owned by the clients and do not need to be used as collaterals. The use of both scenarios simultaneously is expected.

On the supply side, green on-wage financing addresses the technology and contract risks and motivates partner distributors and retailers to supply highly efficient and climate-friendly systems at concessional terms through support mechanisms. The use of a positive list of certified technologies and partner providers will direct the client towards the primary market which ensures that the acquired equipment delivers high quality output in compliance with the programme. Bulk negotiations with technology providers supplying certified energy-efficient and climate-friendly domestic refrigerators provide further incentives to end-users to choose energy efficient technologies acquired at the primary market rather than equipment available at the second-hand market. After successful rebate negotiation, technology providers agree to the terms and conditions for participation in the mechanism on a voluntary basis to be listed by the compliance entity as special partners in order to access the aggregated demand generated by the programme.

Digitisation of customer application process and online shop is recommended. With funds and technical assistance support from NDs, MDBs, GCF, or CTCN, the development of an online shop including smart customer interface and customer application embedding credit risk evaluation and MRV tools is recommended to lower the entry barriers for interested households and administrative costs for partners. In this case, the application process is done through an online shop where the household selects the desired certified brand model and submits the application directly online. Partners' information management systems are fully integrated, while processes are fully automated. Such a centralised digital solution also facilitates the monitoring, reporting and evaluation including MRV of the mechanism.

Recommended involvement of key national stakeholders

The following public and private stakeholders are important and must be closely involved.

- **Ministry of Energy (MOE).** The support from the government is essential for the success of the green on-wage financing mechanism option in the country. MOE can play a key compliance role in the development and implementation of the mechanism, coordination with public stakeholders, facilitating access to the programme to new partners and technologies, promoting certified domestic refrigeration equipment and partners, enforcing the mechanism, and directing households towards the programme. MOE can be central in coordinating and regulating the market and thus offers quality control to households and different stakeholders involved in the proposed financial mechanism when it comes to M&E and MRV as well.

- **Partner financial institutions.** The partner banking or microfinance institutions play a key role in developing, implementing, financing, and promoting the mechanism with support from NDBs, MDBs, GCF, or CTCN. Partner local financial institutions adapt their offering of salary loans or consumer credits to propose green credits, while NDs, MDB and GCF might eventually support partner local financial institutions with green credit lines, revolving loans funds, or credit guarantees to help mitigate further any credit risk and improve concessional lending terms to households, as well as provide technical assistance (from NDBs, MDBs, GCF, CTCN) to promote and develop key components of the mechanism, as well as streamline and digitalise the system integration and processes. NDs, MDBs or GCF advise partner local financial institutions and structure products to reduce their risks and improve their credit terms by eventually offering concessional green credit lines or de-risking instruments to finance energy efficiency investments starting with energy-efficient and climate-friendly domestic refrigerators and providing technical assistance to support the promotion and marketing, as well as the operationalisation and digitisation of the mechanism. Partner local banking or microfinance institutions sign agreements with private and public institutions to extend financing to their employees through green on-wage financing.
- **Partner technology providers of energy-efficient residential refrigerators.** In order to implement the green on-wage financing mechanism option to accelerate the adoption of energy-efficient domestic refrigeration equipment, providers must be involved from the beginning as they will play an important role in supplying the market and serve as technical experts. In the proposed green on-wage financing mechanism, they are the main interface of the programme, allowing the interested household to consult a catalogue of certified and eligible equipment and get a pro forma invoice and credit application material to be then submitted to partner banking institutions and co-verified by the lead compliance entity (e.g., MOE) Once a customer is declared approved, a partner provider of certified brand model will dispatch and install the household equipment on credit and eventually collect the turned-in end-of-life equipment into any eligible e-waste management facilities for disposal.
- **Households.** The principal beneficiaries of the proposed mechanism, on the demand side, are households that must be salaried from private or public institutions that are profiled by or in business with partner local financial institutions. Households have been involved from the beginning and engaged through surveys to ensure that the programme corresponds to their preferences and expectations. Credit and participation conditions to the proposed financial mechanism must be easily accessible, concessional, and transparent, while the application process must be as simple and efficient as possible. Advantages of the programme should be explained through target communications and awareness campaigns. Although the market assessment has already shown findings about households' preferences and expectations, households should be informed continuously on the financial mechanism progress and be invited to provide feedback when possible.

7.8 ANNEX H – Recommended Detailed Implementation Plan of the financing mechanism for Refrigerators

This section describes the recommended detailed implementation plan, including engagement and coordination with partners for the development and implementation of the financing mechanisms. The responsibilities and activities related with the development and implementation of the mechanisms with partners may include, but are not necessarily limited to:

Lead compliance entity (e.g., MOE)

- Source and engage interested local financial institutions and the utility to participate in the selected mechanism
- Source, identify, and analyse vendors of certified energy-efficient and climate-friendly domestic refrigerating appliance brand models
- Source, identify, and analyse e-waste management companies for the collection and disposal of used systems through the mechanism (optional)
- Review the details of banking and microfinance institutions' relevant current financing product schemes (consumer loans, salary loans, credit facilities, hire purchase schemes, etc.)
- Review the details of interested retailers and distributors supplying relevant eligible model brands
- Sign Memorandum of Understandings (MOUs) to officialise partnership with interested local financial institutions and the partner utility
- Support the assessment of full integration of financing support, payments, and flow of funding (including rebate)
- Support the assessment of potential costs for the collection and disposal of used equipment (optional)
- Support the preparation and implement of product eligibility criteria and the positive list of certified systems eligible for financing through the financial mechanism option
- Certify brand models (in alignment with the U4E Model Regulations) offered by interested retailers and distributors based on the product eligibility criteria and agree on the monitoring, testing requirements, and verification protocols for certified products sold through the mechanism (i.e., conformity assessment report, random sample testing, etc.)
- Verify conformity assessment report sent by partner technology providers to approve certified energy-efficient and climate-friendly systems
- Supervise random quality testing of a sample of a subset of these products being certified to verify compliance
- Negotiate bulk rebates with interested providers; partners commit to indirectly bring down financing and prices of certified brand models sold through the mechanism for clients (i.e., vouchers, cash-back, and credit facility agreements with partner local financial institutions)
- Sign Memorandum of Understandings (MOUs) to officialise partnership with partner vendors

- Develop a marketing and promotion strategy that aims to raise awareness of the selected mechanism option during the development and implementation including a "communication toolkit" which includes programme branding, possible press release and social media posts to announce partnership on partner communication channels, as well as support on marketing and promotion to integrate the financing product into partner communication channels
- Refine cost-benefit analysis of certified eligible technologies and internal financial structure, which can help partner local financial institutions to define appropriate financial conditions based on available de-risking or concessional financing support from NDBs, MDBs or GCF to structure financing products to potential customers
- Prepare and implement guidelines to support partner local financial institutions adapt relevant current financing product scheme to deliver of the new financing products to target customers including financing product details, lending terms, conditions, eligibility, and simplified requirements, procedures for reviewing applications, end-user credit assessment template through the on-bill mechanism
- Prepare and implement guidelines and provide framework for monitoring and evaluation (M&E) and monitoring, reporting and evaluation (MRV) for a data management system as part of the mechanism to track financing of approved products to customers and climate benefits attributed to the financial mechanism option (specify the features it should include, recommended protocol for integration into the financial mechanism processes, advising on existing software that may be a good fit for the digitisation of the M&E and MRV, agreement, processes, pricing, etc).
- Certify and oversee the programme and guide households wishing to apply for the programme through partners
- Help structure the flow of information between the different key actors including partner providers of certified brand models, enabling the tracking of project status and develop interface platform and systems for connecting salaried customer or the partner utility's customer applications with partner local financial institutions and technology providers
- Capacity building, training, and implementation meetings with partner local financial institutions to support the development and operationalisation of the mechanism option
- Promote certified domestic refrigerating appliances, technology providers, financial institutions, and partners
- Provide an advisory role to partners for the operationalisation of the mechanism option
- Define, review, and enforce product application and customer application processes and draft standardized agreements and contracts to clarify terms and conditions of participation and responsibilities of different actors (e.g., partner technology providers, partner local financial institutions, the partner utility, etc.)
- Review draft standardized agreement between partner providers and partner local financial institutions and the partner utility including credit terms and conditions for customers in the financial mechanism option as well as rebate on credit
- Support the full financial integration of the collection and disposal of used but operable products into the mechanism option in a financially sustainable manner (covered by the rebate), including the proper disposal of the refrigerant gasses.

- Help partner vendors Identify and negotiate with e-waste management companies which will support on the collection and disposal of gases in an environmental and safe manner
- Capacity building, training, development and implementation meetings with partner distributors, retailers, banking or microfinance institutions, the partner utility, NDBs, MDBs, GCF, CTCN to support the operationalisation of the mechanism option
- Structure financing, support mechanisms, or de-risking mechanisms based on feedback from partner local financial institutions in order to improve on-lending conditions offered to end-users through the financing mechanism

Partner local financial institutions (e.g., banking institutions, microfinance institutions, etc.) and key institutional partners (e.g., the partner utility, etc.)

- Set up green credits facilities with partner technology providers, structure and provide green loans through salary or prepaid metering system deductions with profiled institutions to low-risk salaried customers or with the partner utility to eligible customers on concessional terms (e.g., 0% financing and long tenor periods)
- Implement the positive list of certified brand models, partner distributors and retailers based on product eligibility criteria set by the lead compliance entity
- Develop a quick and simplified credit application procedure for salaried customers or the utility's customers (i.e., credit scoring) wishing to access green loans in exchange of credit repayment on their salary or prepaid metering system with support from profiled employer entities or from the utility
- Define standard credit process and sign standardized contract to clarify terms and conditions of participation and responsibilities of different actors (e.g., partner providers to set up the credit facilities, the partner utility aggregating repayments through prepaid metering system, profiled employer institutions guaranteeing the repayment of the green loans of its salaried employees in the event of default, timing of repayments, transaction costs, etc.)
- Draft standardized agreements with profiled employer entities or the partner utility – the entities responsible of the loan repayment collection. This agreement aims to include the application process, requirements, eligibility criteria for salaried employees or the partner utility's customers, the commitment of the entities to act as guarantor of the loans to customers and define the conditions of such guarantees including the timing of repayments and the transaction cost flow, as well as system integration and credit recovery processes
- Exchange information to help monitor the programme
- Monitor, verify and evaluate the results of programme and exchange information on the extent of green employee loans granted to participating salaried individuals and M&E and MRV
- Analysis of the possibility of extending green consumer loans and credit facilities with partners for other certified climate technologies

Partner technology providers (e.g., domestic refrigerators, off-grid solar refrigerators, etc.)

- Express interest, go through application and certification to participate in the selected financing mechanism and supplying certified energy-efficient and climate-friendly domestic refrigerators in return for negotiated bulk rebates on systems introduced into the market and sold through the programme

- Provide supporting documents to register certified appliances on the positive list based on product eligibility criteria defined by the lead compliance entity (submission of conformity assessment report, random sampling test, etc.)
- Proceed with signing of terms and conditions, and agreement with partner local financial institutions wishing to become partners detailing the rebate, in accordance with policies and regulations
- Implement the monitoring and evaluation (M&E) and the monitoring, reporting, and verification (MRV) guidelines to track the climate benefits of the programme
- Exchange information with partners to track the progress of the programme
- Consider extending the mechanism to supply other types of climate solutions into the market

7.9 ANNEX I – Market Assessment on Distribution Transformers

Overview of the distribution transformers supply chain in Zimbabwe

The stakeholders identified for the manufacturing and distribution of transformers and their expected roles are summarized in Table 7.1. The stakeholders include Government departments and ministries, local authorities, private sector, financial institutions, independent power producers, and consumer associations.

Table 7.1: Stakeholders that were consulted on distribution transformers

Stakeholder	Expected role of stakeholder
Manufacturer/Distributor: ZENT, GEC, Hawker Siddeley Engineering, South Wales Electric, and Nical Transformers	To provide technical and production information as per questionnaire
ZimStat	To provide trade statistics (imports and exports of refrigerators and transformers)
Standards Association of Zimbabwe (SAZ)	To provide standards relevant to the manufacture and supply of refrigerators and transformers in general
Zimbabwe Electricity Transmission and Distribution Company (ZETDC)	To provide information on transformer asset register, standards, regulations, and efficiency specifications
Zimbabwe Energy Regulatory Authority (ZERA)	To provide information on policies and regulations relevant to distribution transformers
Rural Energy Fund (REF)	To provide information on transformer asset register, standards, regulations, and efficiency specifications
Local Authorities: City of Harare, City of Bulawayo	To provide information on transformer asset register, standards, regulations, and efficiency specifications
Department of Irrigation	To provide information on transformer asset register, standards, regulations, and efficiency specifications
Financial Institutions: Infrastructure Development Bank of Zimbabwe (IDBZ), ZB Bank, and Agribank	To provide information on the financing instruments they have for appliances such as transformers
Ministries: Ministry of Energy and Power Development, Ministry of Women Affairs, Community, and Small-to-Medium Enterprises Development, Ministry of Industry and Commerce, and Ministry of Finance	To provide information on policies and regulations relevant to distribution transformers
Private sector: Chamber of Mines (CoM), Confederation of Zimbabwean Industries (CZI), Business Council for Sustainable Development-Zimbabwe (BCSDZ), and Zimbabwe National Chamber of Commerce (ZNCC)	To provide information on transformer asset register, standards, regulations, and efficiency specifications

Stakeholder	Expected role of stakeholder
Non-utility Generators /IPPs: Econet /Distributed Power Africa Tongaat Hulett, Nyangani Renewable Energy (NRE), Greenfuels, Old Mutual, and Renewable Energy Association of Zimbabwe (REAZ)	To provide information on transformer asset register, standards, regulations, and efficiency specifications
Consumer Associations Urban Councils Association of Zimbabwe, Procurement Regulatory Authority of Zimbabwe (PRAZ), and Zimbabwe Environmental Lawyers Association (ZELA)	To provide information on protection of electricity consumers as far as electricity distribution is concerned

Source: Market Assessment, 2021

Trade statistics show that Zimbabwe imported and exported eleven types of transformers for the period 2010-2020 (ZimStat, 2021). The statistics include transmission transformers, distribution transformers and transformers for other appliances. These transformers ranged in size as shown in Table 7.2.

Table 7.2: Transformer type and size ranges

Transformer type	Size range
Core type, oil immersed, max working voltage <=132kv	>=5kva <=650kva
Other liquid di-electric transformers, power handling capacity	<= 650 KVA
Liquid dielectric transformers, core type, oil immersed excl chokes	=<132KV
Other liquid dielectric transformers, power handling capacity	650-10,000KVA
Liquid dielectric transformers, core type oil immersed	=<132KV =<30000KVA
Other liquid dielectric transformers excl core type	>10000KVA
Transformers, NES*, power handling capacity	<= 1KVA and <= 100W
Other transformers, NES, power handling capacity	<= 1 KVA
Transformers, NES, power handling capacity	1-16kva
Transformers, NES, power handling capacity	16-500kva
Transformers, NES, power handling capacity	>500kva

*NES: new equipment sales
Source: Zimstat, 2021

Table 7.3 shows Distribution Transformers imports and exports for 2020. The information on transformer stock could not be obtained during the market assessment.

Table 7.3: Quantities and prices of transformers imported and exported in 2020

	Qty of transformers		Value of transformers (US$)		Unit price of transformers (US$)	
	Imports	Exports	Imports	Exports	Imports	Exports
Core type, oil immersed, max working voltage <=132kv, size >=5kva	699	3	2,705,613	15,277	3,871	5,092

	Qty of transformers		Value of transformers (US$)		Unit price of transformers (US$)	
	Imports	Exports	Imports	Exports	Imports	Exports
<=650kva						
Other liquid di-electric transformers, power handling capacity <= 650 KVA	824	0	474,603	0	576	NA
Liquid dielectric transformers, core type, oil immersed exc. chokes =<132KV	19	0	31,433	0	1,654	NA
Other liquid dielectric transformers, power handling capacity 650-10000KVA	27	0	739,814	0	27,401	NA
Liquid dielectric transformers, core type oil immersed =<132KV =<30000KVA	350	0	147,205	0	421	NA
Transformers, NES, power handling capacity 16-500kva	1,187	14	3,380,545	708	2,848	506
Transformers, NES, power handling capacity >500kva	1,080	1	1,634,278	1,819	1,513	1,819
Total	**4,186**	**18**	**9,113,492**	**24,178**	**2,177**	**1,343**

*NES: new equipment sales
Source: Zimstat, 2021

Equipment stock and projections

ZENT's annual sales volume is around 1,500 transformers mostly towards ZETDC and REF (95%) while mines, farmers, and other customers purchase the remaining 5%. ZENT estimates that the average distribution transformer service life is 25 years. Transformers up to 315 kVA, 11 kV class are pole mounted, while transformers with kVA ratings greater than 315 kVA are pad mounted. Prefabricated (Mini-Substations) are common in urban installations. REF said that four-pole sub-stations are used for transformers up to 250 kVA, which cannot be accommodated between the 'H' poles and single pole hanger, and transformers greater than 250 kVA are ground mounted. Trade statistics show that the most imported transformer types are the oil immersed, core type and the other liquid di-electric transformers.

According to ZETDC (2021) working transformers are not decommissioned. Most distribution transformers are run to failure. Very few are taken out for service. Most of the decommissioned transformers are refurbished, depending on the availability of material. Refurbished transformers constitute around 30% of the total transformer installations in a given calendar year. Most of the refurbished transformers are those with low kVA ratings. 100% testing is done on refurbished transformers to applicable standards including loss assessment.

The market size for each year is shown in Figure 7.6. The estimated market starts at 24,000 in 2021 and is projected to increase to 160,000 in 2040. The contribution of the new DTS

installed in line with electricity demand to the total market size would increase from 83% in 2021 to 90% in 2040 while those of the replacement DTs would a combined total contribution of 17% in 2021 and 10% in 2040. Multiplying the market size with the average distribution transformer price of US$2,181, calculated from the 2020 trade statistics provided by ZimStat, gives a distribution transformer market value ranging from USD 50 million in 2021 to around USD 350 million in 2040.

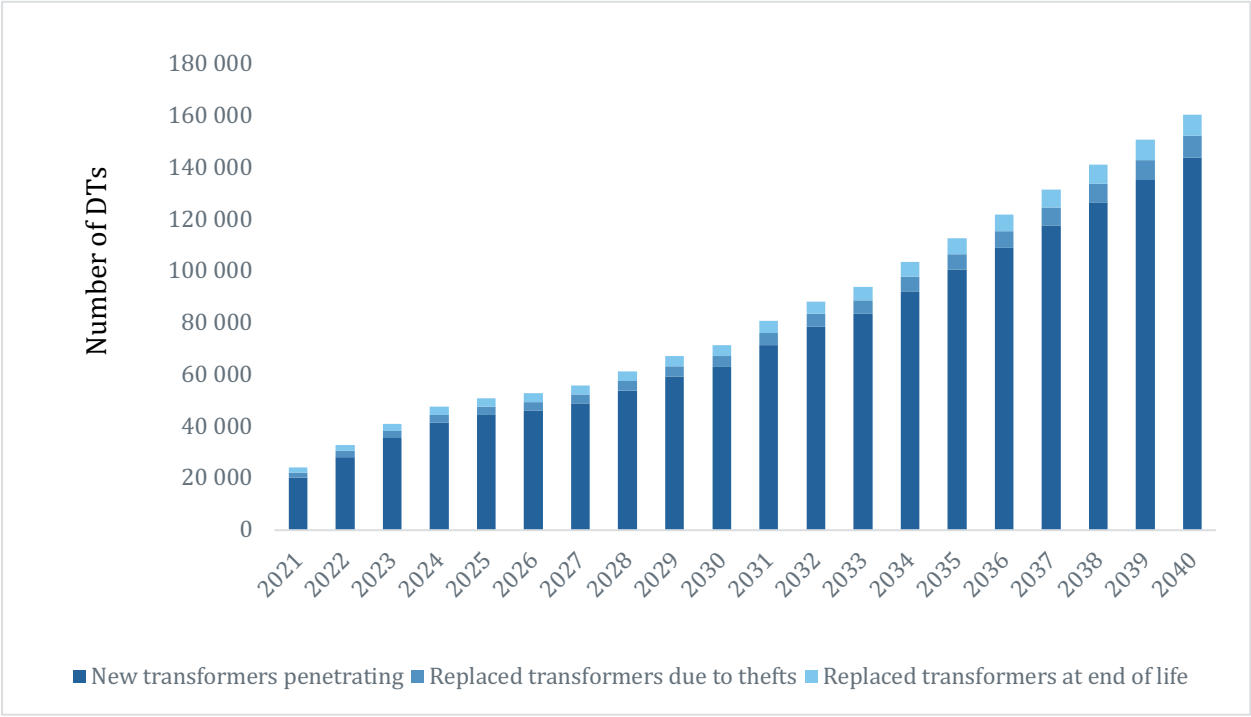

Figure 7.6: Market size for distribution transformers

Source: Market Assessment, 2021

Following the United Nations Environment Programme's (UNEP) United for Efficiency (U4E) Country Savings Assessments Methodology[13] energy savings from higher efficiency DTs were performed by:

- Calculate the installed MVA from the projected electricity demand
- Split the MVA demand between the residential, commercial, and industrial sectors, using the latest sales statistics
- For each sector specify the MVA percentages of the DT types (3 phase liquid-filled, single-phase liquid-filled, and 3 phase dry-type), and specify the average transformer size
- Assume 30% of the residential DTs (250 kVA and 50 kVA) are rewound and rewinding was assumed to increase the energy losses by 2.25%.
- Calculate the BAU, Level 1 and Level 2 DT energy losses

[13] https://united4efficiency.org/wp-content/uploads/2019/10/U4E-Country-Savings-Assessments-2019-Methodology-and-Assumptions.pdf

- Subtract the Level 1 and Level 2 losses from the BAU to get the Level 1 and Level 2 energy savings
- Use the grid emission factors used in the NDC Implementation Framework to calculate the emissions reduction. The EF was around 0.76 kg/kWh for the period 2021-2024 and 0.436 kg/kWh from 2025 to 2040.

The assumptions used in this study are summarized in Table 7.4.

Table 7.4: Assumptions on DT types, kVA ratings, and losses

Sector	TD type	Contribution	Average TD size (kVA)	Losses without considering rewinding		
				TD loss (BAU)	TD loss (Level 1)	TD loss (Level 2)
Residential	Three phase liquid-filled	47%	250	13,841	9,746	7,512
	Single phase liquid-filled	53%	50	4,227	3,197	2,352
	Three phase dry type	0%	N/A			
Commercial	Three phase liquid-filled	92%	400	19,710	13,841	10,508
	Single phase liquid-filled	0%	N/A			
	Three phase dry type	8%	630	31,536	26,280	24,221
Industry including agriculture	Three phase liquid-filled	98%	800	27,419	19,491	14,804
	Single phase liquid-filled	0%	N/A			
	Three phase dry type	2%	630	31,536	26,280	24,221

Policies and programme landscape

The Electricity Distribution Code Regulations (SI 47 of 2017) require that the Distributor identify and report separately to ZERA the Technical and Non-Technical Losses in its Distribution System. The Technical Loss shall be the aggregate of conductor loss, the coil in transformers, and any loss due to technical metering error. The distribution grid code does not specify energy efficiency standards for distribution transformers. The code classifies transformer losses under technical losses. The utility is then requested to declare its technical and non-technical losses to ZERA for the purposes of agreeing on a cap for system losses that are transferred to the tariff. ZERA requires that the distribution losses be not more than 8%.

The distribution network uses 11 kV and 33 kV. The distribution transformers manufactured by ZENT are 96-98% efficient at full load. Loss evaluation of transformers is as per SANS780. According to the Distribution Transformers Procurement specifications, transformers shall be connected in accordance with BS 171: three phase transformers to Vector Group reference Dyn11, and the transformers shall be fitted with low viscosity mineral insulating oil which complies in every respect with the provisions of BS 148.

The Distribution Code specifies the following:

- Unless otherwise specified in Schedule of Requirements, it must be assumed that the system on which the equipment will operate as is:
    - Three phase overhead-line construction and underground system. The maximum earth fault factor on the network is 1.5.
    - Operated at 50 Hz, with approximately sinusoidal wave form.

  - The highest system voltage does not normally exceed the nominal system voltage by more than 10%. The nominal system voltages are 33 kV and 11 kV.
  - The system frequency variation does not exceed plus or minus 2.5% from 50Hz.

- All materials used in the manufacture of the transformers shall be new and of high commercial quality.
- The transformers shall be manufactured to high quality standards. (The specification is silent on the core material; it only mentioned that "particular attention shall be paid to maintaining low core loss consistent with sound design")
- Tenders should advise to which standard the transformers are manufactured and tested and shall supply relevant test certificates or test results.
- The transformers shall be sourced from manufacturers who have ISO 9001 Certification. Evidence of the ISO 9001 Certification shall be provided with the bid. Manufacturers who cannot submit such certification are liable to be rejected.

Current and planned electrification policies and programmes

Zimbabwe, through its National Renewable Energy Policy, aims to increase the percentage of renewable energy in its energy mix and set some renewable energy targets 1,100 MW and 2,100 MW for 2025 and 2030 respectively. Table 7.5 shows the breakdown of the 2030 target. The rural electrification projects which are meant to increase the electricity access by the rural population would also result in increased distribution transformer installations. Moreover, most rural electrification projects are relatively inefficient in that load centres are sparsely distributed, and the lines are long.

Table 7.5: Installed capacities of renewable power generation technologies by 2030

Technology	2030 Target (MW)
Small Hydro	150
Grid Solar	1,575
Wind	100
Biogas and other RE	275
Total Renewable Energy target	2,100

Source: National Renewable Energy Policy, 2019

Environmental regulations for oil-filled transformers and current program status

Zimbabwe uses the standard IEC60422 for the operational guidelines in dealing with Polychlorinated Biphenyls (PCB's). According to the country's biggest supplier of transformers, ZENT (2021), samples are collected from suspected transformers prior to any repair works, and PCB contamination is measured in accordance with IEC 60422 which gives a threshold of 50 ppm.

Opportunities and barriers towards energy-efficient distribution transformers

Stakeholders recommended provided the following recommendations to enable the local market transformation toward more energy-efficient distribution transformers

- The Ministry of Industry and Commerce and Bureau Veritas can assist with Consignment Based Conformity Assessment for transformers.

- The grid is owned and maintained by ZETDC and because of this, financial institutions hardly finance the purchase of transformers. The financial institutions may fund REF's electrification projects, e.g., the electrical reticulation between the transformer and the new residential households.
- The asset register of transformers should be accessible to all stakeholders who need it.
- Training on green procurement for both public and private institutions would be necessary.

7.10 ANNEX J – Recommended Detailed Implementation Plan of the financing mechanism for DTs

This section describes the expected involvement of key stakeholders, as well as the engagement and coordination with partners for the development and implementation of both options. The responsibilities and activities related with the development and operationalisation of the selected option with partners may include, but are not necessarily limited to:

Lead compliance entity (e.g., Ministry of Energy, MDBs, NDBs, GCF, CTCN if providing financing and technical assistance, etc.)

- Source, identify, and analyse ESCOs and technology providers of certified energy-efficient and climate-friendly distribution transformers.
- Source and engage interested local financial institutions to participate in the selected mechanism.
- Sign Memorandum of Understandings (MOUs) to officialise partnership and initiate technical assistance with interested ESCOs and/or technology providers of EE DTs, financial institutions (e.g., commercial banks, MDBs, NDBs, GCF) if providing financing, major end-users (e.g., power utility, non-utility market players), and partner government institutions (e.g., MOF, procurement regulatory authority, custom authority, etc.) during the development and implementation phase of the selected mechanism.
- Review the details of interested ESCOs and/or technology providers supplying eligible DT technologies.
- Review the details of interested banking institutions' relevant current financing product schemes.
- Review the details of the procurement regulatory authority and the Power Utility and major non-utility market players' procurement policies, regulations, framework, and processes.
- Support the assessment of full integration of procurement and financing support, tendering and payments, and flow of funding for the selected financing mechanism.
- Support the preparation and implementation of commercial and technical eligibility criteria for financing (e.g., positive list) and review and amendment of technical specifications and procurement regulations through the selected financial mechanism.
- Certify eligible DT technologies (in alignment with the U4E Model Regulations) based on the product eligibility criteria and agree on the monitoring requirements, and verification protocols for certified products supplied and/or procured through the selected mechanism.
- Verify conformity assessment report sent by partner ESCOs, technology providers to approve certified energy-efficient and climate-friendly equipment through the selected financing mechanism option.
- Support policy and legal framework reforms to support the selected financing mechanism option (e.g., procurement, finance, customs, etc.)

- Refine cost-benefit analysis of eligible EE DT technologies and internal financial structure, which can help partners to define appropriate financial conditions based on available de-risking or concessional financing support from MDBs, NDBs, or GCF to structure financing products to potential clients.
- Prepare and implement guidelines to support partner financial institutions green relevant current financing product scheme to deliver of the new financing products to target clients including financing product details, lending terms, conditions, eligibility, and simplified requirements, procedures for reviewing applications.
- Prepare and implement guidelines and provide framework for monitoring and evaluation (M&E), monitoring, reporting and evaluation (MRV) for a data management system as part of the mechanism to track financing of approved products to clients, energy savings, and climate benefits attributed to the selected financial mechanism option (specify the features it should include, recommended protocol for integration into the financial mechanism processes, advising on existing software that may be a good fit for the digitisation of the M&E and/or MRV, agreement, processes, pricing, etc).
- Certify and oversee the programme and guide ESCOs, technology providers, financial institutions, and end-users wishing to apply for the programme through partners.
- Define, review, and enforce program processes and draft standardized agreements and contracts to clarify terms and conditions of participation and responsibilities of different actors (e.g., ESCOs, power utility, non-utility market players, participating technology providers, partner financial institutions, etc.) in the selected financing mechanism option.
- Review draft standardized agreements among lead compliance entity, ESCOs, technology providers, end-users, and partner financial institutions including energy savings agreements, procurement specifications, credit terms and conditions for end-users in the selected financial mechanism option, etc.
- Provide an advisory role to partners for the development and operationalisation of the selected mechanism.
- Capacity building, training, development, and implementation meetings with ESCOs, participating technology providers, financial institutions, the power utility, MDBs, NDBs, CTCN, other partners, to support the operationalisation of the selected mechanism.
- Develop and implement a marketing and promotion strategy that aims to raise awareness of the selected mechanism option during the development and implementation including a “communication toolkit” which includes programme branding, as well as support on marketing and promotion to integrate the financing product into partner communication channels.
- Promote certified EE DTs, partner ESCOs, participating technology providers, partner financial institutions, pilot projects, and other partners.
- Consider extending the mechanism to supply other types of climate solutions into the market beyond the program implementation through the Super ESCO model led by energy efficiency agency.

Partner ESCOs and/or participating technology providers (e.g., manufacturers and distributors of EE distribution transformers)

- Express interest with lead compliance entity to develop and implement the selected financing mechanism.
- Sign Memorandum of Understandings (MOUs) to officialise partnership and receive technical assistance from lead compliance entity to structure financing mechanism with interested end-users (e.g., the power utility, non-utility market players), financial institutions (e.g., MDBs, NDBs, GCF, commercial banks, etc.) during the development and implementation phase of the selected mechanism.
- Provide supporting documents including financial statements, technical standards of equipment, procurement specifications, etc.
- Support the assessment of full integration of financing and procurement support, tendering and payments, and flow of funding for the selected financing mechanism.
- Support the preparation and implementation of commercial and technical eligibility criteria for financing (e.g., positive list) and/or procurement technical specifications through the selected financial mechanism.
- Comply with product eligibility criteria, additional or revised procurement regulations and agree on the monitoring requirements, and verification protocols for certified products supplied and/or procured through the selected mechanism.
- Support cost-benefit analysis of eligible EE DT technologies and internal financial structure, which can help partners to define appropriate financial and procurement conditions based on available de-risking or concessional financing support.
- Develop and implement the monitoring and evaluation (M&E), and monitoring, reporting, and verification (MRV) guidelines to track the energy savings and climate benefits of the selected financing mechanism option.
- Proceed with signing of terms and conditions, and agreements with lead compliance entity, end-users (power utility, non-utility market players), and other partners for the development and implementation of the selected financing mechanism.
- Exchange information with partners to track the energy savings and progress of the development and implementation of the selected financing mechanism.
- Support the development and implementation of a marketing and promotion strategy that aims to raise awareness of the selected mechanism option.
- Consider extending the mechanism to supply other types of climate solutions into the market beyond the program implementation.

Power Utility:

- Express interest with lead compliance entity to develop and implement the selected financing mechanism.
- Sign Memorandum of Understandings (MOUs) to officialise partnership and receive technical assistance from lead compliance entity to structure financing mechanism with partner ESCOs and/or participating technology providers, non-utility market players, financial institutions (e.g., commercial banks, NDBs, MDBs, GCF), other government institutions, during the development and implementation phase of the selected mechanism.
- Provide supporting documents including financial statements, technical standards of equipment, procurement documents including technical specifications and processes, etc.

- Support the assessment of full integration of financing and procurement support, tendering and payments, and flow of funding for the selected financing mechanism.
- Support the preparation and implementation of commercial and technical eligibility criteria for financing (e.g., positive list) and/or additional or revised procurement through the selected financial mechanism.
- Comply with product eligibility criteria, additional or revised procurement regulations, and agree on the monitoring requirements, and verification protocols for certified products supplied and/or procured through the selected mechanism.
- Support cost-benefit analysis of eligible EE DT technologies and internal financial structure, which can help partners to define appropriate financial and procurement conditions based on available de-risking or concessional financing support.
- Develop and implement the monitoring and evaluation (M&E), and monitoring, reporting, and verification (MRV) guidelines to track the energy savings and climate benefits of the selected financing mechanism option.
- Proceed with signing of terms and conditions, and agreements with lead compliance entity, ESCOs and/or participating technology providers, other partners, and non-utility market players for the development and implementation of the selected financing mechanism.
- Exchange information with partners to track the energy savings and progress of the development and implementation of the selected financing mechanism.
- Support the development and implementation of a marketing and promotion strategy that aims to raise awareness of the selected mechanism option.
- Consider extending the mechanism to supply other types of climate solutions into the market beyond the program implementation.

Partner financial institutions (e.g., MDBs, NDBs, banking institutions) and key institutional partners (e.g., GCF, CTCN, etc.)

- Set up green credits lines or credit guarantees with ESCOs and/or end-users (power utility, private users), structure and provide green loans and develop quick relevant application procedures.
- Define standard credit process and sign standardized contract to clarify terms and conditions of participation and responsibilities of different actors
- Draft standardized agreements between ESCOs and end-users where the shared savings model or the guaranteed savings model terms are accurately stipulated.
- Exchange information to help monitor the programme.
- Monitor, verify and evaluate the results of programme and exchange information on the extent of green loans granted to ESCOs and/or end-users
- Analysis of the possibility of extending green loans and credit lines with partners to promote investment in other climate technologies through the selected financing mechanism.
- Support the development and implementation of a marketing and promotion strategy that aims to raise awareness of the selected mechanism option.

7.11 ANNEX K - Monitoring, Verification, and Enforcement (MV&E)

The Monitoring, Verification, and Enforcement (MV&E) is a core component of the integrated policy approach toward energy efficiency market transformation. It revolves around monitoring markets, verifying compliance, and enforcing regulations on companies that fail to meet them. MV&E's major activities are:

- Monitoring: market surveillance activities to identify potential cases of non-compliance
- Verification: testing or processes to evaluate the product's performance compared to its claimed energy performance usually through third-party
- Enforcement: acting against non-compliance offenses with a suite of timely and appropriate actions

Error! Reference source not found. highlights the fundamental aspects of MV&E.

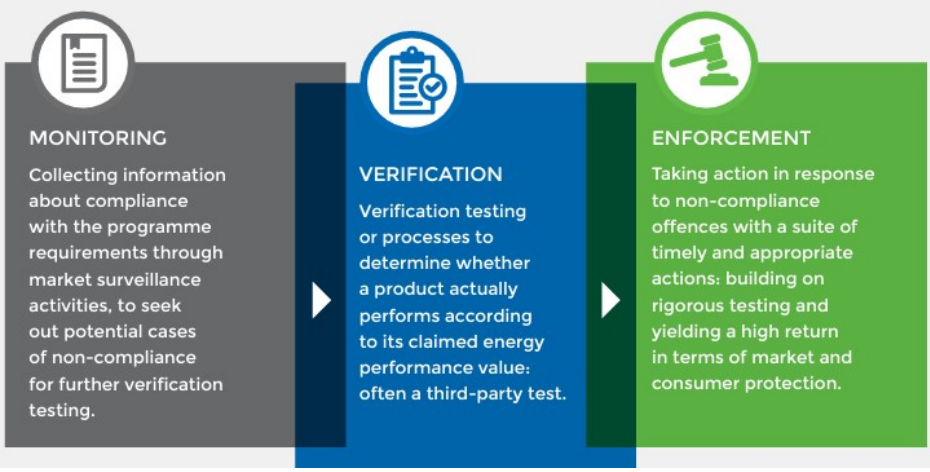

Figure 7-7: MV&E Process

Source: U4E (2017). Accelerating the Global Adoption of Climate-friendly and Energy-Efficient Refrigerators[14]

The benefit of a proper MV&E program is to ensure compliance as summarized in Figure 7-8.

Figure 7-8: Benefits of Proper MV&E Program for Energy-Efficient Appliance and Equipment Regulation

Source: Toolkit: Monitoring, verification, and Enforcement (MV&E), IEA

[14] http://united4efficiency.org/wp-content/uploads/2017/06/U4E-RefrigerationGuide-201705-Final-R1.pdf

MV&E is considered a mechanism with the highest return in terms of market and consumer protection. An effective MV&E scheme ensures policy integrity and creates a level playing field where manufacturers comply with standards and labelling programmes, consumers receive the benefits promised by the appliance label, and government achieves target national impact (i.e., energy savings and emissions reduction towards their NDC goals).

When starting to implement the MEPS and Labels program, the following issues must be reviewed to identify:

- Regulatory authority power
- Public and private technical capacity
- Required market entry conditions and testing infrastructure
- Compliance assessment
  - How to streamline the process
  - How to regularly monitor and survey the market
  - How to verify the performance
  - What are the potential areas of non-compliance

This information is then used by the designated authority to:

- Design the market entry conditions, as shown in **Error! Reference source not found.**.
  - Recognize the cost distribution between the Government/Program, Industry Participant, and Consumer
  - Understand the trade-off in complexity for the different entry conditions.
- Devise the market surveillance plan
- Develop the verification plan – regional harmonization and discussions with major trade partners can be quite important in this step
- Develop an enforcement plan with a penalty structure (monetary and otherwise)
  - Penalty should be commensurate with the level of offense
  - Visible and communicated with the region (e.g., SADC) and trade partners
    -

Table 7-6: Trade-off between entry conditions and distribution of costs

Entry Condition	Distribution of Costs		
	Government/ Programme	Industry Participant	Consumers
In-house testing, calculation or self declaration allowed	High cost in market surveillance & verification testing	Low compliance costs	None
Independent tests required	Medium cost in market surveillance & verification testing	Medium initial compliance costs	May fund compliance costs in price of equipment
Third-party verification and/or certification required	Low cost in market surveillance & verification testing	High initial compliance costs	May fund compliance costs in price of equipment

Figure 7-9 depicts the overall framework for planning and reviewing the MV&E regime for appliance standards and labelling.

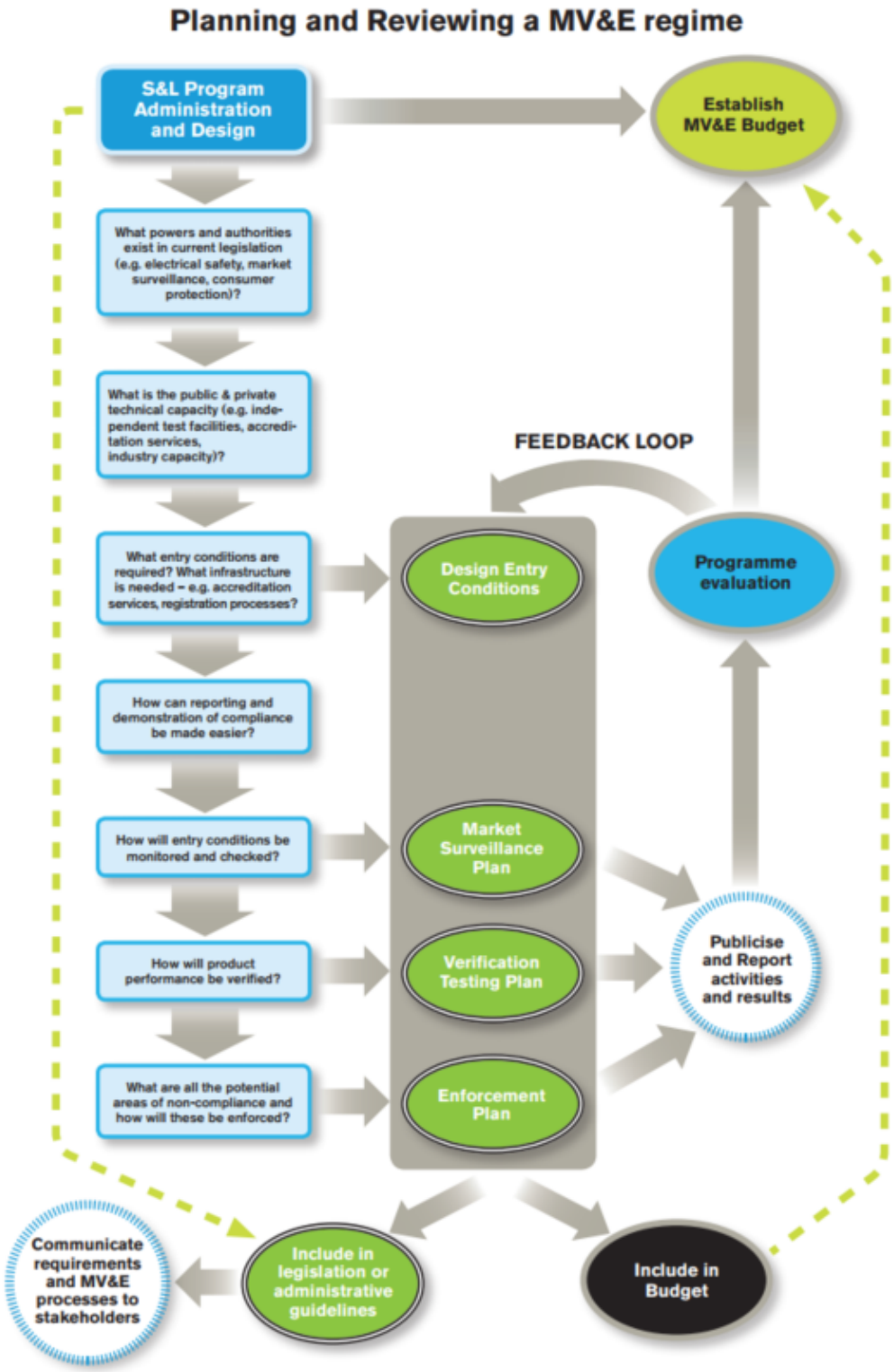

Figure 7-9: Planning and reviewing an MV&E regime

Source: Compliance Counts: A Practitioner's Guidebook on Best Practice Monitoring, Verification, and Enforcement for Appliance Standards & Labeling, CLASP[15]

[15] https://clasp.ngo/publications/compliance-counts-a-practitioners-guidebook-on-best-practice-monitoring-verification-and-enforcement-for-appliance-standards-labeling

Figure 7-10 presents a typical MV&E plan for DTs.

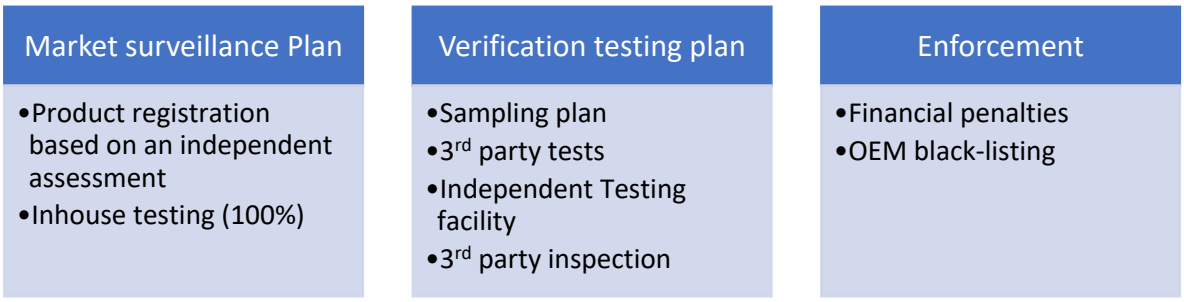

Figure 7-10: Typical MV&E plan for DTs

The following concerns must be considered in planning MV&E

- **Legal and Administrative Framework**

When establishing the requisite legal powers and processes, the first step is to assess existing legislation and administrative procedures to determine what extant legal powers and authorities exist to enforce similar regulations. If suitable existing frameworks exist, MEPS and labelling legislation can take advantage of these to speed up implementation and minimize costs.

Legal frameworks must clearly delineate responsibilities between the different government agencies that implement MV&E nationally. Including, for example, the agency responsible for coordinating the MV&E scheme and agencies such as customs and standards and metrology.

An important aspect of MV&E for refrigerators is that in addition to *energy performance* itself, *refrigerant gases* and *foaming agents* should be part of the programme (if legal requirements have been set for these gases). In this case, MV&E should at least cover information requirements that are crucial to facilitate recycling. Their nature and volume should be tested to determine their GWP and ODP.

- **Specification of Requirements**

Conformity assessment procedures need to be specified for each regulated product and should be included in the applicable legislation. These procedures must be drafted and adopted by the regulators responsible for MEPS and energy labelling.

A conformity assessment procedure includes steps by suppliers and officials to ensure that products adhere to MEPS and labelling requirements before being placed on the market. It includes testing to determine performance, a declaration of performance, and documenting the assessment.

The procedure lists the steps that a supplier must follow to ensure that a product that they wish to place on the market complies with all legislative requirements. If the requirements are unclear to suppliers or impractical, there is an elevated risk of non-compliance and missing documentation, even when market actors aim to abide by the law.

The aim is to secure the confidence of consumers and public authorities in the conformity of regulated products, allow fair competition between manufacturers/importers in the conformity of regulated products, and ultimately ensure that the environmental objectives are met.

U4E Guidance on Ensuring Compliance with MEPS and Energy Labels further presents examples of conformity assessment protocols for refrigerators, as cited in European Union regulations[16].

- **Product Registry Systems**

The establishment of a product registration system (PRS) is good practice to offer an initial compliance gateway whereby suppliers register products with the regulatory authority, and to enhance conformity. When government sets up PRS, it has to do so via legislative and/or regulatory authority.

The registration process usually requires manufacturers/importers to submit test results on the products and certify that the product performance meets the MEPS, and/or any labelling requirements before the product can be placed on the market. Such registration systems can facilitate market compliance controls. Suppliers need to enter product information into the database.

With the system in place, the assigned ministry checks declarations and supporting documentation. If all required information has been provided and automatic consistency checks are satisfactory, the ministry either grants permission for the product to be placed on the market by providing a mandatory *registration number* or withholds approval until identified issues have been resolved. Additional manual assessment is necessary to verify that all the details have been properly provided and that there are no contradictions or other remaining non-compliance concerns.

Such a system helps ensure that there is a systemic third-party inspection of the technical documentation and that the supplier is fully aware of the requirements. It is important that the parameters in the PRS permit the calculation of each product's energy efficiency so that the consistency of this information with the declared energy efficiency can be checked.

The data fields typically recorded in the PRS databases for domestic refrigerators include brand, model, category (for example refrigerator, refrigerator-freezer), volumes of the different compartments, climate class, nature, and volume of refrigerant gases.

U4E guidance notes on product registration systems further outline best practices[17].

- **Testing Laboratory**

Although having a national laboratory can be a prestigious asset to manage, in reality, laboratories are expensive facilities to establish, commission, earn accredited and maintain. A certain minimum level of business generated by the market is needed to sustain the laboratory and to ensure it has adequate revenue to operate.

Countries with smaller economies should consider looking at outsourcing their laboratory test needs to neighbouring countries or other entities until their economy grows and they are able to justify direct investment in a domestic facility. Sharing of facilities themselves is not a common practice due to the difficulty of transporting refrigerators long distances. However, the same results can be achieved by simply sharing test results. This should be considered in particular for neighbouring countries that have similar products on their markets and have chosen the same test standard for their MEPS and labels.

[16] https://united4efficiency.org/resources/ensuring-compliance-with-meps-and-energy-labels/

[17] UNEP U4E (2020) Product Registration System Guidance Notes include 1) What is a Product Registration System and Why Use One? 2) Planning to Build a Product Registration System? – Foundational Considerations 3) Planning to Build a Product Registration System? 4) Detailed Consideration Implementing a Product Registration, all available at: https://united4efficiency.org/product-registration-systems/

- **Communications**

Communication is a critical element of any successful MV&E scheme. For manufacturers/importers, it helps to ensure they are aware of their legal obligations, and what happens if they were found to be non-compliant. For consumers, it lets them know that their government is working hard for them, ensuring that the national market for a given product offers a fair and level playing field. Communication can also be a powerful tool in gaining the respect of regulated businesses, and improving compliance rates –

In order to achieve these programmatic outcomes, it is necessary for the government to develop a communications plan. This plan should be fine-tuned and appropriate for the domestic market, taking into account all the main stakeholders involved in the supply chain, and the importance of communicating key messages to them about the requirements themselves, the risk of detection and sanctions, and any corrective action taken.

The government may consider identifying products and brands that are non-compliant (also called the “name and shame” approach).

In addition to these communications tools, there are a number of tools, training activities, and guidance that can be offered by the government, which will help improve rates of compliance. For example, the government can offer training courses explaining the regulatory requirements. It can maintain a regulatory hotline or email service to answer questions that suppliers may have, publish a frequently asked questions (FAQ) website, and provide guidance on compliance reporting and documentation requirements. All of these approaches will help to minimise the costs of demonstrating compliance and ensure higher compliance rates and more successful outcomes.

- **Market Surveillance Management and Responsibilities**

Market surveillance is conducted by a designated market surveillance authority. As market surveillance is also required for electrical safety, compliance with the Montreal Protocol, and so forth, surveillance functions may be conducted in the same agency rather than separately to avoid duplication of efforts. The techniques are similar, so there can be synergies that provide better value for money. However, adequate market surveillance must also be carried out for energy performance reasons, and the responsible agency must be adequately invested in this arena. The approach typically depends on the primary legislation and the relevant responsibilities of line ministries.

- **Conformity Verification**

Conformity verification begins with the market surveillance authority but links to customs authorities who are responsible for some level of inspection of products to ensure they are approved for entry when they record customs data. Customs authorities need to be informed of MEPS and labelling activities and be actively engaged.

This needs to include training customs officials, linking compliance software tools, and establishing inspections at custom authority control points with supporting back-office expertise supplied by the market surveillance authority. Where product registration systems are used with a remote pre-approval mechanism, customs authorities should have access to the database of compliant registered products to be able to verify that the imports are in the database and permitted to enter the country. Also, check products manufactured/imported within the country, check retailers, and respond to complaints of non-conformity.

The degree to which conformity verification actions are systemic or only conducted at the request of the market surveillance authority is a trade-off, balancing careful consideration of the cost and complexity relative to the benefit of enhancing compliance. The types of

conformity verification, ordered from least costly but least certain, to most certain and more costly, include:

- Documentation inspection and consistency checks.
- Visual inspections at the point of entry.
- In-person inspections at stores and online distribution facilities.
- Verification testing at laboratories on energy performance and the stated refrigerant gas and foam blowing agent.

- **Regulatory Enforcement**

In cases of non-compliance, the enforcement authority should carefully consider the degree of non-compliance. The available enforcement actions should be flexible, enabling the enforcement authority to assess the non-compliance situation and initiate a proportionate action. The penalties and powers of the enforcement authority should be set out in law.

The toolkit of powers and actions should be further outlined in administrative procedures or operational guidelines.

Many enforcement authorities develop an "Enforcement Pyramid" to inform and manage their enforcement response strategies. The bottom of the pyramid typically features more informal actions, while the top of the pyramid should reflect the most severe enforcement response to non-compliance (see Figure 7-11**Error! Reference source not found.**).

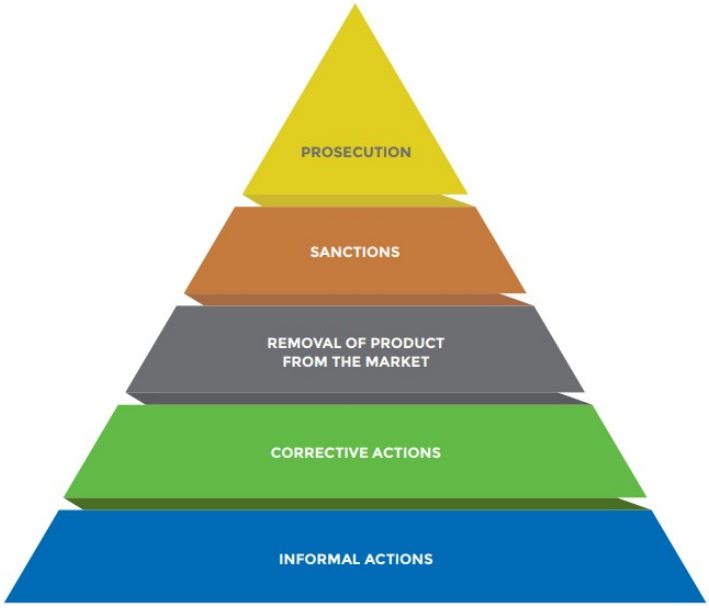

Figure 7-11: Pyramid of Escalating Enforcement

Source: UN Environment (2017)[18]

Recommendation

In order to lower the barrier to the market transformation towards energy-efficient refrigeration appliances, the government might want to consider using soft market entry conditions

[18] U4E Policy Guide Series: Accelerating the Global Adoption of Climate-Friendly and Energy-Efficient Refrigerators, UN Environment, 2017

- Importers needs to provide third-party test certificate and up-to-date product labels for each model imported
- Each imported appliance should bear the Energy Label in compliance with the adopted standard

Furthermore, the MV&E officials would need to be trained to verify the labels and the test certificates; this would require:

- Organizing capacity-building activities
- Develop virtual and self-guided training modules (1-hour modules) for customs and other MV&E officials through the EELA training platform https://training.eela-project.org/
- Develop brochures for customs officials in the local language
- Coordinate with local training centres to train officials from relevant government organizations and large wholesalers

Finally, the designated authority may wish to explore regional coordination and consider the establishment of a regional product registry to minimize the cost associated with product certification and a regional alert system to ensure that if an offense is revealed in one of the countries, other countries are made aware to avoid potential dumping (diverting of low-quality products to neighbouring countries).

The enforcement framework should follow a systematic approach as shown below:

1. The designated authority submits a notice of non-compliance to the importer
2. The importer is allowed to provide rebuttal information – e.g., third-party test certificates, updated product labels, etc.
3. The designated authority inspects the rebuttal information
    a. If valid, update the product registry and/or affix the modified label
    b. If not valid the designated authority has to reject the non-compliant shipment, inform SADC partners of the offense to warn against dumping, and ensure the non-compliant shipment is returned to the country of origin or properly disposed of at additional cost (e.g., reclaim refrigerant charge, recycle plastic and metal, and incinerate or recycle polyurethane foam)[19].

[19] More information about end-of-life can be found at: GUIDE № 4, Recycling and Disposal of Refrigeration and Air Conditioning Systems at the End-of-Life Phase, September 2020 (https://www.semanaspodsmexico.info/files/guide_4_eol.pdf)

7.12 ANNEX L – Awareness Raising and Education Campaigns

Awareness-raising communication campaigns support national strategies to promote energy-efficient appliances and equipment through MEPS and labelling. In addition to these, changes in end-user behaviour (purchasing more energy-efficient appliances and equipment) can also contribute to energy savings, by making end users more "energy aware" through communication and education programmes.

CASE STUDY: Market Transformation Through the Introduction of Energy Efficiency Standards and the Labelling of Appliances in South Africa

In South Africa, the communication and public awareness campaign under the Market Transformation project started relatively late but has gained momentum in the last couple of years of the project. The mass publicity campaign in newspapers, radio, and television was undoubtedly the key piece to raising consumer awareness about the benefits of energy-efficient appliances and contributed to the recognition of the EE label by the appliance end-users.

Although it commenced relatively late and lasted only for a short period, the campaign proved to be effective. However, the fact that related training of the retailers' staff was delayed for almost 2 years after the development of the training module shows insufficient coordination and harmonization in the implementation of the campaign and the retailers' staff training. UNDP recommended that the awareness-raising campaign and related promotional programmes should continue beyond the project time boundary since achieving full market transformation and a shift towards energy-efficient appliances requires a cultural change that requires continued efforts.

Source: UNDP (2020). Terminal Evaluation Report[20]

Designing a Communications Campaign

The success of a communications campaign depends on its design of the following elements:

- ***Objectives*** should be established in line with policy goals. The objectives should be specific, measurable, attainable, relevant, and time-bound (SMART). They determine the choice of communication tools and messages as well as evaluation parameters.
- ***Communication messages*** should be simple and relevant to the audience. Messages should make the desired behaviour attractive and easy and should clearly demonstrate the benefits to end users. Usually, monetary savings are a strong motivator in all communications campaigns about efficiency, but in some countries, messages that tap into a sense of national pride may resonate as strongly.
- ***Communication plans*** should be flexible. They should allow for adjustments based on monitoring results and any circumstantial changes. Project-

[20] https://erc.undp.org/evaluation/documents/download/16823

management skills are needed to successfully manage the launch and ongoing operation of the campaign. Diagnostic skills are used to recognise whether the campaign fulfills its expectations. If the campaign falls short of its goals, then its problems must be addressed.

- ***Target audience*** should be correctly identified for a communications campaign. This helps in tailoring the messaging to that audience.
- ***Communication tools*** should include both offline and online channels. Some means of external marketing communication with target audiences are, for example, digital television, and advertising on websites. For written media (offline), the tools can be brochures, annual reports, handbooks, or newsletters. The *energy label* also constitutes a successful tool to communicate or provide information about the energy consumption of an electrical appliance to help consumers choose products with increased energy efficiency.

  Typical stakeholder education tools include:
  - Organizing events at selling places
  - Training of trainers for key stakeholders
  - Roadshows
  - Exhibitions taking advantage of the local energy exhibits
  - Brochures
  - TV and Radio advertisements

Figure 7-12 depicts the four major target audiences for a communications campaign around energy-efficient appliances and equipment, with some examples of the stakeholders who can be found in those major groups as follows:

- **Government and institutions** that support regulatory and legislative work and oversee policy implementation
- **Retailers and distributors** who facilitate the education of end-users through advertising and training of salespersons
- **Media** that engage end-users in communication campaigns
- **End-users** who should receive clear information and messaging to help make informed decisions

Figure 7-12: Major Target Audiences for a Communication Campaign

Source: UN Environment (2017)[21]

Table 7-7 provides more information on the communication interests of these major target audiences. It includes their primary interests and their areas of involvement with respect to energy efficiency for appliances. How exactly various groups of stakeholders are engaged varies a lot between countries and should be defined taking into account the cultural context and available resources. For example, the US has a culture of documenting all decisions and rationale. All stakeholders listed above are invited to take part in the discussions to build a negotiated consensus. The Mexican process relies mostly on subsets of selected stakeholders gathered in technical committees.

Table 7-7: Communication campaign stakeholders and areas of interest and involvement

TARGET AUDIENCE	PRIMARY INTEREST	AREAS OF INVOLVEMENT
INSTITUTIONS/ GOVERNMENTS **• Governments (potentially several ministries)** **• Electric utilities** **• Standards organisations** **• Customs authorities** **• Testing labs** **• Trade unions** **• Lobbying organisations – environmental advocacy; industry association**	• For refrigerators several ministries may be involved: industry, energy, climate, and environment; each of which would have different interests • Reduce electricity use and GHG emissions through energy-efficient and climate-friendly appliances • Ensuring efficiency standards and product quality in the market • Ensure competitiveness of local manufacturers on global markets • Promote market penetration.	• Support regulatory and legislative initiatives and policy implementation through available funding opportunities. • Provide experienced support in identifying success factors for promoting efficient appliances and market transformation. • Evaluate and monitor processes against established targets. • Provide in-kind support to regulatory and legislative initiatives and policy implementation through technical expertise. • Institute green public procurement programmes where only top labelled products would be acceptable.

21 U4E Policy Guide Series: Accelerating the Global Adoption of Climate-Friendly and Energy-Efficient Refrigerators, UN Environment, 2017

BUSINESS • **Manufacturers** • **Industry associations** • **Wholesalers and retailers** • **Specifiers** • **Building owners and managers** • **Recyclers**	• Promoting innovative, energy-efficient new technologies • Business prospects • Corporate responsibility • Reducing electrical consumption • Managing the end-of-life of refrigerators.	• Facilitate direct and indirect end-user communication • Guide key actors in promoting sustainable policies and transforming markets to efficient appliances • Provide best practice solutions at the local, regional, or international level • Provide guidance on technical feasibility and realistic time schedules.
END USERS • **Customers** • **Civil society** • **Consumer and community associations** • **Environmental organisations**	• Acquire information to make informed decisions about the savings associated with a switch to efficient refrigerators • Own energy-efficient products.	• Accept and utilise of energy efficient appliances based on first-hand experience and affordability • Provide information about buying habits • Increase the market share of energy-efficient refrigerators and sustain the change in consumption patterns.
MEDIA AND OTHERS • **Media** • **Research and training institutes** • **Universities**	• Increase awareness and develop knowledge about energy-efficient refrigerators among professionals and consumers.	• Disseminate information on energy-efficient refrigerators and their benefits to consumers • Identify best practices and policies • Assist governments in implementing sustainable appliance policies • Publish formal and informal education and training materials.

Source: UN Environment (2017)[22]

In addition, effective communication and education campaigns should gain the active support of the key stakeholders. They should focus on the range of *benefits and outcomes* that end users will enjoy as a result of seeking out and selecting higher-efficiency appliances

[22] U4E Policy Guide Series: Accelerating the Global Adoption of Climate-Friendly and Energy-Efficient Refrigerators, UN Environment, 2017

(refrigerators) or equipment (transformers). If end users can feel good about the outcome, they are more motivated to take an interest in seeking out information and to understand why it is meaningful to their purchasing decision. Dry, factual messages will have less impact than positive, beneficial statements.

Programme implementers should avoid developing complicated or technical text, graphs, or charts. Messages should be factual enough to be compelling but also user-friendly and simple to be memorable. Some successful energy efficiency communications campaigns have focused on the following benefits and attributes:

- Monetary savings
- National pride
- Energy efficiency and energy savings
- Convenience (long life)
- A simple and hassle-free switch
- Environmental responsibility
- Political and economic advantages and
- Energy security and reliability.

Recommendation

Zimbabwe is considering the design and implementation of its first batch of MEPS and labeling. Energy labeling is a critical component of national market transformation efforts, which allow consumers to make informed purchasing decisions. The campaign will focus on publicizing the refrigerator label and establishing brand recognition around energy efficiency labels for subsequent campaigns. While for distribution transformers (DTs); the communication will focus on educating key stakeholders on the impact of higher-performance DTs and the financial benefits of integrating MEPS in their procurement guidelines. The following recommendations are made as follows:

- **Peer-to-peer communications** (networking/ collaborating peers or partners that define clear functions for the parties involved) should be used to create social and group pressure to change behaviour among like-minded or in physical neighbourhoods/ communities. The combined information instruments can be used such as website, e-groups, media reports, public service announcements etc.
- Campaigns should be designed based on a clear legal framework and contain more practical information on how to comply with the new legal framework. For instance, more focus can be on providing facts about the energy efficiency refrigerator. This can also be combined with efforts to ***inform the consumer about the benefits and environmental advantages***. Finally, these campaigns should also provide ***information on available financing schemes***.
- These campaigns need to work across ongoing interventions to provide ***tailored communications messages*** related to the value and function of the product, environmental consequences of switching towards efficient refrigerators, and encourage spin-off effects and local initiatives, like technician capacity building.
- Developing economies working on increased electrification rates may wish to consider equitable access to information and benefits for *low-income groups*. As such, the role of ***retailers, point-of-sale information, and local promoters*** is crucial in promoting higher-efficiency products. Retail personnel typically affect consumer choices, particularly in rural areas. Awareness and training activities should be directed to retail personnel on the benefits of efficient refrigerators,

with information exchange workshops on promotion campaigns in small cities and rural towns. More skilled and knowledgeable retail staff or other professionals that give advice options can be complemented by more extensive point-of-sale information in terms of information posters or signage.

- ***Localized, pilot-tested messages*** from different points of view are recognized across the literature on international best practices. for smaller-sized campaigns, or campaigns for a shorter duration, it is important to consider how messages add value or complement ongoing campaigns. Humour and positive reinforcement are considered preferred campaign angles as indicated by several international experiences.
- Multiple ***channels*** and ***approaches*** are needed to support the communications and behavioral change objectives. These may include ***TV spots (most popular and effective), radio advertisements***, ***road shows***, and involving school children in various writing and drawing competitions with award ceremonies. In nearly all campaigns reviewed, ***information dissemination (top-down)*** was combined with more engaging methods and approaches (e.g., social networking media, school competitions), and in setting up systems for peer-to-peer communications to occur.

For a developing economy like Zimbabwe, and with the aspirational goal of increased electrification, information access is important. As such, the Zimbabwean authorities may wish to consider a multi-pronged approach to stakeholder education that include:

- **Mini film series** (5 minutes/film) providing the public with information on the benefits of energy-efficient refrigerators
  - The episodes should be developed with different themes, using different real characters or a real character throughout the series. It will be most effective to broadcast the series during prime time on both central and local levels.
- Organize **training, workshops, and forums** related to EE refrigerators shall be held each year for different target groups
  - Officials in government and power utilities
  - Retailers, wholesalers, and salespersons
  - Media agencies and consumers
- Organize **contests nationwide** to support the educational campaigns to encourage the purchases of higher efficiency refrigerators among the Youth Union members nationwide
- Print **communication materials** such as leaflets, panels, posters, notebooks, and student notebooks with contents related to the transition towards higher efficiency environmentally friendly refrigerators shall be designed and printed nationwide
- Explore **links with DSM activities by the electric utility** (roadshows; ZETDC responses to consumers who inquire about high electricity bills: opportunity to encourage them to buy higher efficiency refrigerators).
- Explore **links with Institutions** that have social media channels (e.g., Facebook pages and or blogs) related to energy efficiency to use them to disseminate this information.
- Leverage networks of PWG members.
- Provide timely "**Training of Trainers**" (including current members of the PWG).
- Develop **tailored educational campaigns** for the different target groups (utility and non-utility DT market). These education campaigns should also target municipalities. financial benefits of integrating MEPS in their procurement guidelines. For other customers, it is important to consider including MEPS in public procurement for DTs