



National Policy Roadmap

Draft

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

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)**

August 2022

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List of Abbreviations

| | |
|-----------------|-------------------------------------------------------------------------|
| AEC | allowable energy consumption |
| BRRRA | Business Regulatory Review Agency |
| CEC | Copperbelt Energy Corporation |
| CO ₂ | Carbon Dioxide |
| CTCN | Climate Technology Centre & Network |
| DSM | Demand Side Management |
| DT | distribution transformer |
| EAC | East African Community |
| EACREE | East African Centre of Excellence for Renewable Energy and Efficiency |
| EE | Energy efficiency |
| EEl | Energy Efficiency Index |
| EE&C | Energy Efficiency and Conservation |
| EPCs | Energy Performance Contracts |
| ERB | Energy Regulation Board |
| ESCO | Energy Service Company |
| GCF | Green Climate Fund |
| GRZ | Government of Zambia |
| IAEREP | Increased Access to Electricity and Renewable Energy Production Program |
| IDC | Industrial Development Corporation |
| IEC | International Electrotechnical Commission |
| ISO | International Organization for Standardization |
| MEPS | Minimum Energy Performance Standards |
| MoE | Ministry of Energy |
| MoFNP | Ministry of Finance and National Planning |
| MV&E | Monitoring, Verification, and Enforcement |
| NDB | National Development Bank |
| NEP | National Energy Policy |
| NETFA | National Electricity Test Facility, South Africa |
| NRM | National Roadmap |
| NSO | National Statistical Office |
| PRS | Product Registration System |
| PWG | Policy Working Group |
| REMP | Rural Electrification Master Plan |



| | |
|----------|--------------------------------------------------------|
| RESAP | Renewable Energy Strategy and Action Plan |
| SACREEE | SADC Centre for Renewable Energy and Energy Efficiency |
| SADC | Southern African Development Community |
| SADCSTAN | SADC Cooperation in Standards |
| S&L | Standard and Labelling |
| TC | Technical Committees |
| TCO | Total Cost of Ownership |
| U4E | United for Efficiency |
| ZABS | Zambia Bureau of Standards |
| ZCSA | Zambia Compulsory Standard Agency |
| ZEMA | Zambia Environmental Agency |
| ZESCO | Electricity Supply Corporation of Zambia Limited |
| ZPPA | Zambia Public Procurement Authority |
| ZRA | Zambia Revenue Authority |

1 Background

As part of Zambia’s commitment to implement various energy efficiency strategies of the identified appliances and equipment, Ministry of Energy (MoE), submitted a request for technical assistance to Climate Technology Centre & Network (CTCN). This allowed Zambia to be part of the eight countries in Southern African Development Community (SADC) embarking on GCF Readiness projects on “Developing a national framework for leapfrogging to energy efficient appliances and equipment (refrigerators and distribution transformers (DT)) 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.

1.1 Country Background and International Commitments

Zambia is a large, landlocked country in Southern Africa, and its climate is highly variable. Over the last few decades, Zambia has experienced a series of climatic extremes, e.g., droughts, seasonal floods, flash floods, extreme temperatures, and dry spells, with increased frequency, intensity, and magnitude. The climate change impacts on the country are increasingly considerable stress on the country’s vulnerable sectors.¹

The Government of Zambia (GRZ) submitted its first Intended Nationally Determined Contributions (INDCs) to the UNFCCC in 2016 and resubmitted its updated NDC in 2020. Zambia intends to reduce its greenhouse gas emission by 25% by 2030 at Business-As-Usual (BAU) with limited international support prevailing in 2015, and towards by 47% with substantial international support compared to 2010. This NDC was submitted with a conditional pledge of reducing greenhouse gas emissions consisting of mitigation and adaptation components based on the country’s national circumstances for 2015-2030. The mitigation actions were focused on three programmes: (1) Sustainable Forest management, (2) Sustainable agriculture, and (3) Renewable energy and energy efficiency.²

Zambia’s overall national energy objectives are to promote sustainable national development by creating conditions that ensure the availability of an adequate and reliable supply of a diverse energy mix at the least economic, social, and environmental costs. These objectives are guided mainly by the National Energy Policy (NEP) 2019, Vision 2030, and the 7th National Development Plan. These national strategies have common goals: to facilitate universal energy access and achieve key sustainable development goals. As part of its national energy strategy, Zambia is implementing energy efficiency initiatives, including promoting efficient energy services and switching to other alternative energy sources and technologies. Specific efforts have been on developing energy performance standards for lighting lamps, electric motors, and solar water heaters. However, these efforts need to be well coordinated and extended to other energy services.³

¹ Climate Change Knowledge Portal, World Bank. <https://climateknowledgeportal.worldbank.org/country/zambia>

² Final Zambia revised and updated NDC 2021. https://unfccc.int/sites/default/files/NDC/2022-06/Final%20Zambia_Revised%20and%20Updated_NDC_2021_.pdf

³ National Energy Policy, Lusaka: GoZ, 2019

As previously mentioned, Zambia is among the eight countries in SADC that have embraced a common approach for the implementation of the Green Climate Fund (GCF) Readiness projects on ‘Developing a national framework for leapfrogging to energy efficient refrigerators and distribution transformers.’

Zambia stands to be guided by the regional practice set by East African Community (EAC) and SADC. Reference is made to the Technical Note on quality and performance metrics of cooling Products for EAC and SADC, Part I: Refrigerating Appliances. The Note refers to the Montreal Protocol which evolved to address climate change mitigation as well, with the 2016 Kigali Amendment establishing a framework for reducing global hydrofluorocarbon (HFC) use,⁴ where Zambia is a signatory to both. The note supports the effort of EAC and SADC to establish and improve energy-efficiency standards for room air conditioners (ACs) and refrigerating appliances by providing an overview of global market and policy trends and technical recommendations in a harmonized way across the region.

Since 2020 Zambia has been part of an additional regional effort which is the harmonization of minimum energy performance standards (MEPS) and labels for residential refrigerating appliances and room air conditioners. The countries of the EAC and SADC are working together with the project partners SACREEE, EACREEE and UNEP-U4E to develop harmonized MEPS and labels for refrigerating appliances and ACs. The project is particularly noteworthy in this context as it focusses on the same appliance as the national project for Zambia, namely on energy efficient refrigerating appliances. The regional MEPS for refrigerating appliances have been drafted and are 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.⁵

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

- Comply with minimum energy performance in terms of 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 in accordance with 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 Zambia

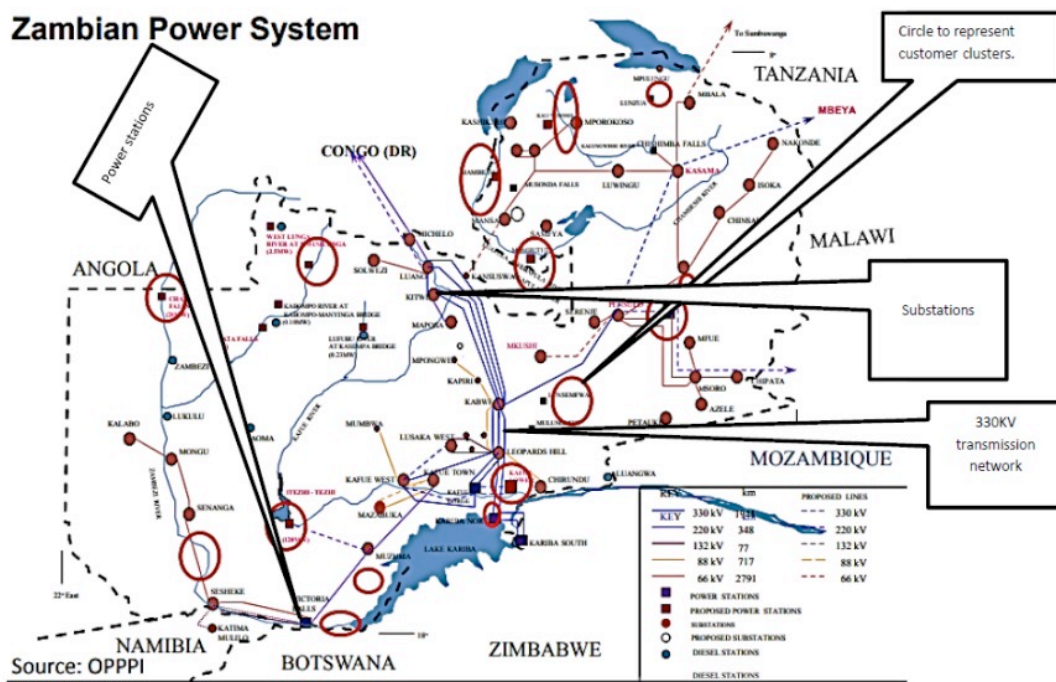
⁴ W.Y. Park et al. 2020. Technical Note on Quality and Performance Metrics of Cooling Products for EAC and SADC. s.l.: UN Environment Program, 2020.

⁵ <https://united4efficiency.org/country-regional-activities/eac-sadc/>

Energy has been identified as an important driving force behind economic development in Zambia, and the government has declared its commitment to developing and maintaining energy infrastructure and services. The electricity industry in Zambia has been restructured since 1994 with a focus on liberalizing and promoting private investment in the industry, particularly in power generation. The amendment of the Electricity Act in 1995 abolished the statutory monopoly of Zambia Electricity Supply Corporation (ZESCO), while the Energy Regulation Act of the same year established the Energy Regulation Board (ERB) as an independent regulator of the energy sector. Because of these reforms, the power sector has opened up to IPPs for on-grid and off-grid transactions.

Zambia's electricity sector comprises the vertically Integrated Public Utility Company, ZESCO Limited, IPPs, and Power Distribution Entities. The ZESCO utility is wholly state-owned through the Industrial Development Corporation (IDC), the holding company for most state-owned enterprises in Zambia. ZESCO owns and operates over 90 % of the country's generation, transmission, and distribution assets and supplies electricity to all grid-connected consumers, except for some mining consumers in the Copperbelt Province, which are served by the Copperbelt Energy Corporation (CEC). CED is a private company that purchases bulk power from ZESCO to supply to the mines. The power utility (ZESCO) is under the jurisdiction of the Ministry of Energy (MoE) and operates based on the policies established by MoE.

The ZESCO transmission grid comprises transmission lines and substations at 330 kilovolts (kV), 220 kV, 132 kV, and 66 kV high voltage levels, with transmission and distribution lines of 9,975 km. The Copperbelt Energy Corporation (CEC) network consists of 220 kV and 66 kV lines, with 41 substations. See Figure 1-1 of the country's power network system.



Source: (ERB, Energy Sector Report, 2019)

Figure 1-1: Zambia's Power Network System

Electricity in Zambia is transmitted at 330 kV, 220 kV, 132 kV, and 66 kV and distributed at 33 kV and 11 kV. Distribution transformers are used to step down the voltage level to 380-400 V for a 3-phase network and 220-240 V for a single-phase network.

1.2.1 Electricity Demand

In 2019, Zambia's electricity generation mix was predominantly hydro, accounting for 80.45% of installed capacity. The remainder of the generation mix comprised coal (10.06%), Heavy Fuel Oils (3.69%), diesel (2.80%), and solar (2.99%)⁶ In 2019, the national installed capacity of electricity increased to 2,981.31MW, representing a 2.86% increase from 2018.⁷

The country's electricity demand has been growing at an average of about 3%, or between 150 and 200 MW per year, annually based on historical data.⁸ With an assumption of 150 MW growth in peak demand, Zambia's electricity demand is expected to double in 2030 to above 4500 MW, with an expected installation capacity above 5500 MW (get-invest, 2020).⁹

1.2.2 Access to Electricity

In 2019, the overall household electricity access rate was around 39.4% nationally. Access to electricity in Zambia is dramatically low, especially in rural areas. It is estimated about 4.4% of households in rural areas have access to electricity, and 67.3% in urban areas.¹⁰ Increasing access to energy is a key priority of the national development strategy and the government has set electrification targets at 90% for urban areas and 51% for rural zones by 2030 resulting in 80% national average by 2030. However, at the current pace, these targets are still challenged to be achieved due to limited investment and macroeconomic growth in Zambia.

1.3 National Policies on Energy, Energy Efficiency, and Conservation

The energy sector in Zambia is efficiently managed through a policy framework that meets the ever-rising challenges in the energy sector and the economy as a whole. The National Energy Policy 2019 (NEP 2019) builds on previous policies of 1994 and 2008 and is anchored on the Seventh National Development Plan (7NDP) and Vision 2030.

The NEP 2019 aims to guide the energy sector in developing the electricity generation, transmission, and distribution capacity. The NEP 2019 also incorporates current developments in the energy sector, the entire economy, and the regional and international environment. The NEP 2019 includes priority areas on energy efficiency and renewable energy. Its objective on energy efficiency is to promote efficient use of energy resources to conserve national resources for the benefit of the future generation. Further, strengthening institutional capacity, facilitating innovative research and development in the energy sector, and promoting private sector participation in the energy sector.¹¹

The Zambia's energy legal framework sector is currently governed by four major statutes namely:

- 1) The Energy Regulation Act
- 2) The Electricity Act

⁶ Energy Sector Report, Lusaka: ERB, 2019

⁷ ZESCO, 2020

⁸ Zambia Energy, Zambia Development Agency, (ZDA, 2021).

⁹ get-invest, 2020. Zambia Energy Sector_ Market Overview. <https://www.get-invest.eu/market-information/zambia/energy-sector/>

¹⁰ National Energy Policy, Lusaka: GOZ, 2019.

¹¹ National Energy Policy, Lusaka: GoZ, 2019

- 3) The Petroleum Act
- 4) The Rural Electrification Act.

The Energy Regulation Act established the Energy Regulation Board, as a body corporate, whose primary role is to license entities that intend to produce energy. The Electricity Act provides for the regulation of generation, transmission, distribution, and supply of electricity. The Petroleum Act provides for the importation, conveyancing, and storage of petroleum and other inflammable oils. The Rural Electrification Act established the Rural Electrification Authority whose primary role is to provide electricity to rural areas of Zambia.

As part of its national energy strategy, the Zambia government through the MoE has put in place efforts to support the enactment of legal instrument that will help establish a framework to support the energy efficient and renewable energy sub-sector. Further to the Renewable Energy Strategy and Action Plan (RESAP), the Energy Efficiency Strategy and Action Plan is under development with support from the European Union under the Increased Access to Electricity and Renewable Energy Production Program (IAEREP).¹²

Zambia is implementing energy efficiency initiatives which include promoting efficient utilization of energy services, and specific efforts have been on the development of energy performance standards development. Zambia aims to transition to efficient refrigerators and distribution transformers by adopting the technical standards that are in place through the national standard body, Zambia Bureau of Standards (ZABS). There are only technical standards for refrigerators, and distributional transformers, except these standards, are not mandatory, and the scope of these standards does not include aspects of product energy efficiency. Product labels and financial mechanisms that could support this transition are also non-existent in Zambia, as most financial institutions do not have programs that directly or indirectly support or promote the use or manufacture of energy efficient refrigerators or distributional transformers.

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 Zambia are summarised in Table 1-1.

Table 1-1: Key Institutions in Zambia

| Main Organisation | Description /Role |
|------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ministry of Energy (MoE) | MoE is responsible for developing and managing energy resources in a sustainable manner for the people's benefit and supervising the statutory bodies and parastatals: Energy Regulation Board (ERB), Rural Electrification Authority (REA), and ZESCO Limited. MoE role is to coordinate, promote and implement energy policies and planning (MEPS and labelling program) on policies and regulations relevant to distribution transformers and refrigerators. |
| Zambia Bureau of Standards (ZABS) | ZABS is a statutory body under the Ministry of Commerce, Trade and Industry. ZABS has a mandate of developing specific standards and providing conformity assessment services to industry to support regulations on both safety and minimum energy aspects in collaboration |

¹² EU IAEREP program (EU, 2021), <https://nao.gov.zm/2019/05/the-iaerep-programme/>

| | |
|--------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | with stakeholders. ZABS role is focused toward supporting the industry to implement standards that enhance the quality of products and services. |
| Zambia Compulsory Standard Agency (ZCSA) | ZCSA is a statutory body under the Ministry of Commerce, Trade and Industry. ZCSA has a mandate to administer, maintain and ensure compliance with compulsory standards for all imported products for the purpose of public safety and health, consumer protection, and environmental protection. ZCSA role is to conduct market surveillance for imported products within the scope of compulsory standards. |
| Zambia Revenue Authority (ZRA) | ZRA is responsible for collecting revenue on behalf of the GRZ under the supervision of the Ministry of Finance. Customs Division, under ZRA, monitors entry of electrical appliances and works with ZCSA to carry out compliance checks on imported products under MEPS and labelling program. |
| Energy Regulation Board (ERB) | ERB is mandated to regulate and balance the interest of all energy stakeholders in a manner that facilitates sustainable energy development for socio-economic transformation. The role of ERB is to ensure consumers receive a quality service at an affordable price while balancing a reasonable rate of return to energy utilities. ERB will supporting ZESCO in the implementation of MEPS and labelling programs and financing mechanisms. |
| Zambia Electricity Supply Corporation Limited (ZESCO) | As a national electricity utility, ZESCO has a mandate for the system's electricity operation, transmission, and distribution. ZESCO role is to support and provide information on transformer asset register, standards, regulations, and efficiency specifications, including to support the implementation of MEPS and labelling programs and financial instruments (e.g., on-bill financing/repayment). |
| Business Regulatory Review Agency (BRR) | BRR is a Statutory Body under the Ministry of Commerce, Trade and Industry. The mandate of BRR is to review and approve proposed policies and laws that affect business activity to ensure they are legitimate and serve the intended purpose as well as coordinate development and implementation of appropriate government-to-business interventions. BRR will supporting MoE and ZCSA in the implementation of MEPS and labelling programs. |
| Zambia Public Procurement Authority (ZPPA) | ZPPA is an independent statutory regulatory body establish by the Public Procurement Act (PPA) No.12 of 2008. ZPPA is responsible for regulate public procurement of goods, works and services, and issue standard bidding documents and other Standard Procurement Documents. ZPPA will advise MoE and relevant entities on procurement policy in the implementation of MEPS and labelling programs and financial instrument. |
| Zambia Environmental Agency (ZEMA) | ZEMA role is to advise government and the private sector on environmental management and pollution control matter, issue environmental certificates, undertake environmental monitoring, promote environmental awareness, and enforce regulations and standards, e.g., to control refrigerant and other hazardous substances. |

2 About the National Policy Roadmap

2.1 Scope

The NPR aims to provide technical guidance to improve Zambia'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 Zambia 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 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
- Monitoring, verification and Enforcement (MV&E) plan

The list of institutions and members represented in the Policy Working Group is found in ANNEX A – Members of the Policy Work Group.

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 – Members of the Technical Committee for Refrigerating Appliances (TC-REF) and ANNEX C – Members of the Technical Committee for Distribution Transformers (TC-DT).

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

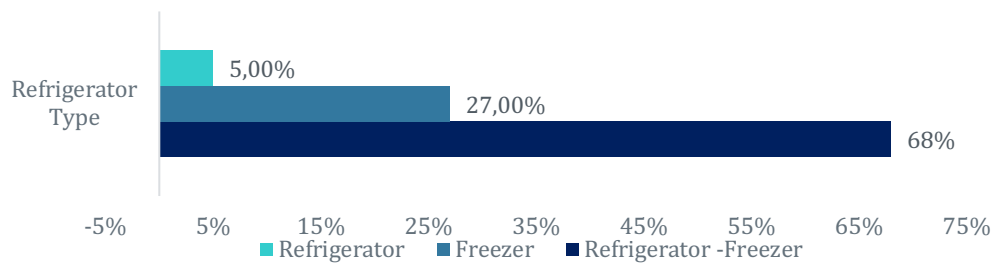
A holistic interaction between these elements ensures successful creating an enabling policy and regulatory environment and market transformation for refrigerators and distribution transformers including the ability for continuous improvement in the energy performance in Zambia.

3 Refrigerators

Zambia does not have local manufacturers for any residential refrigeration appliances; imports drive the refrigerator supply in Zambia’s market. The total import value of residential refrigerators to Zambia reached \$766 million in 2020, an increase of about 3.68% compared to 2019.¹³ The market supply chain for residential refrigerators in Zambia is dominated by distributors who import from various countries. South Africa has the largest share of the Zambian refrigerator imports market (76%), followed by China (5.5%), Turkey (4.5%), and India (4.2%), respectively.

The Zambian refrigerating market is dominated by the refrigerator-freezer appliance, as shown in Source: Residential Refrigerator Survey, 2021

Figure 3-1 .The average volume was found to be 346 litres corresponding to annual energy consumption of 112kWh. 81% of the refrigerators were the direct cool technology type; amongst these, the majority were refrigerator-freezer type, and only 19% used frost-free technology. Refrigerating products with R600a and R134a refrigerant were the most used in Zambia. Of which 78.3% were used R600a and 18.1% used R134a, respectively.



Source: Residential Refrigerator Survey, 2021

Figure 3-1: Market share by Refrigerator Type

The ownership rate for households’ refrigerators in Zambia shows that most (94%) of Zambia households owned a single refrigeration appliance. Of 63.1% of households owned one unit of Refrigerator-Freezer type, 31.7% owned one freezer unit, and only 5.2% owned more than one refrigeration appliance. The consumer indicated purchasing new refrigerators (80%), while only 20% bought second-hand products.

The market size for residential refrigerators in Zambia is assumed to be driven by the need to replace the old ones at the end of life and supply new demand. The new demand is assumed to be proportionate to the economic growth at an average of 3.1%. The market projections use the economic model to project growth in refrigeration equipment by an estimated 32% by 2030. The market size is expected to grow slightly below 100,000 residential refrigerators with a corresponding market value above 43,000,000 USD (720,000,000 ZMW) by 2030, as shown in Figure 3-2. This corresponds to an increase in refrigerating appliance stock from 74,606 units in 2021.

¹³ TrendyEconomy, 2021. <https://trendeconomy.com/data/h2/Zambia/8418>

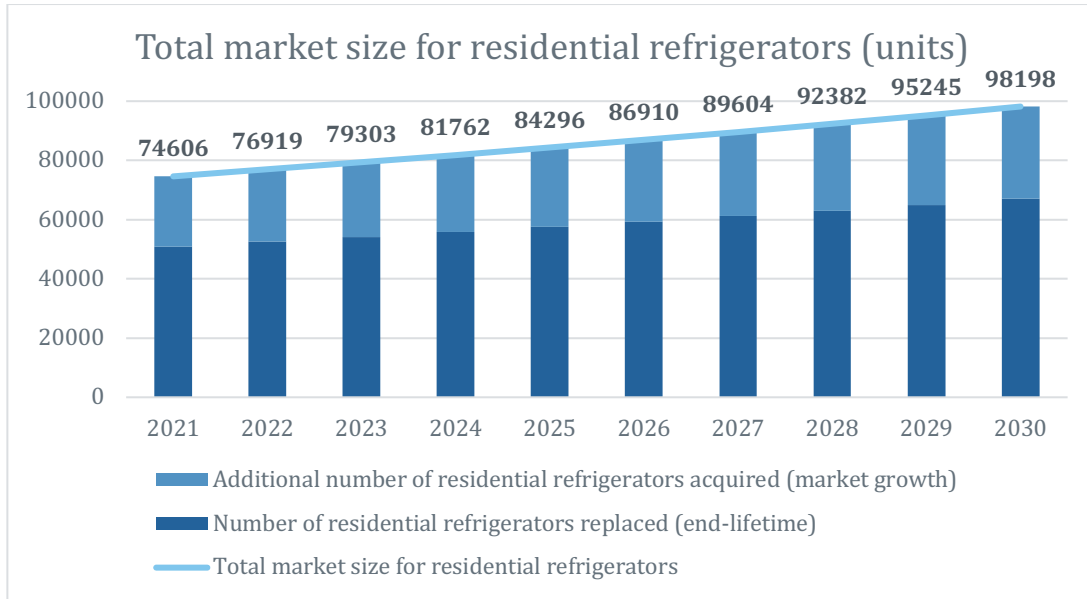


Figure 3-2: Projected number of residential refrigerator-freezers acquired and replaced in Zambia

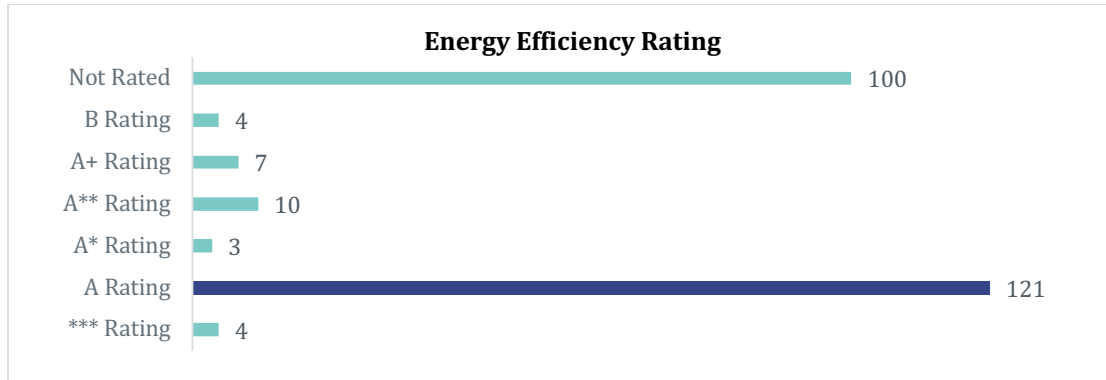
3.1 Minimum Energy Performance Standards

3.1.1 Current Situation

Currently, Zambia does not have a mandatory MEPS. All refrigerators imported into the country are subject to inspections and should meet ZS 106 'Safety of Household and Similar Electrical Appliances' Specifications. ZCSA carries out compliance mandated to check imported refrigerators products as a listed compulsory product. However, general requirements to certify refrigerators' compliance in Zambia are limited to energy efficiency. No deliberate policy or regulation requires that these imported appliances are checked for energy efficiency at the border entry.

The majority of the residential refrigerators in the market found 48.9% are "A" energy efficiency rating (48.9%), and beyond "A" rating (A*, A**, A+) found by 8%, and "B" rating found by 1.6%. However, 40.1% were found to have not been energy efficiency rated. Most efficiency-rated products are sourced from South Africa, and those with power consumption ratings range between 61 to 240 kWh. Among those that did not have energy efficiency rated, the power rating went between 181 and 240 kWh. ¹⁴ Figure 3-3 shows the energy efficiency rating of refrigerators products in Zambia's households.

¹⁴ Market Assessment Report on Residential Refrigerators and Distribution Transformers in Zambia, UNEP-CTCN GCF Readiness Project on "National framework for leapfrogging to energy efficiency appliances and equipment", 2021.



Source: Residential Refrigerator Survey, 2021

Figure 3-3: Energy Efficiency Rating of Refrigerators in Zambia’s Households.

Since 76% of the refrigeration appliances available to consumers in the Zambian market were imported from South Africa, and almost 50% were rated as Class “A” per South African standards rated appliances, we can consider it to be the baseline energy efficiency level. The imported units from South Africa are generally tested according to the South African test standard SANS 62552-2008. The SANS 62552-2008 standards contain both the test method and the labels for South Africa, based on the IEC 62552-2007. The remaining refrigerating appliance in the market are imported from China and Europe, which are typically tested according to IEC 62552-2015.

In South Africa, the VC9008 Regulation sets the MEPS rating at the Label Class B ($55 \leq EEI < 75$) and Class C ($75 \leq EEI < 90$) 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.¹⁵ 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.

The technical committee recommended starting with a voluntary MEPS following the SADC harmonised MEPS. Zambia is currently working with the SADC Cooperation in Standards (SADCSTAN) secretariat in collaboration with UNEP-U4E, SACREEE, and EACREEE, SADCSTAN to develop regionally harmonized MEPS for cooling appliances, refrigerating appliances and air conditioners. The project aims to establish MEPS for cooling appliances, including refrigerators.

3.1.2 Recommended MEPS

Currently, Zambia 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 Zambian

¹⁵ 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

Authorities may wish to consider phase step approach that following the SADC harmonised MEPS.

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

AEC_{Max} is calculated for the different equipment classes, as shown in Table 3-1.

Table 3-1: 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 3-2. 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 3-2: Minimum R Requirements for Refrigerating Appliances

| Product Category | R Requirement (Phase 1: by 2023) | R Requirement (Phase 2: by 2026) |
|----------------------|----------------------------------|----------------------------------|
| Refrigerators | 1.0 | 1.25 |
| Refrigerator-Freezer | 1.0 | 1.25 |
| Freezers | 1.0 | 1.25 |

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 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 Zambian 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.¹⁶

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 Zambia's MEPS with the test standard of IEC 62552-3: 2015.

3.1.3 Actions & Timeframe

According to UNEP-U4E¹⁷, the MEPS development process involves several steps, as shown in Figure 3-4. The overall responsibility of the NPR implementation and MEPS regulation lies with the MoE to establish a legal framework and guidance on policy and execution for household refrigerators. MoE 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 Zambia Bureau of Standard (ZABS), Zambia Compulsory Standards Agency (ZCSA), and the Zambia Revenue Authority (ZRA).

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 Zambian Authority may wish to consider ZCSA to be the custodian of the standard.

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

- PWG members

¹⁶ 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

¹⁷ UNEP/U4E: Policy guidebook for climate-friendly and energy-efficient refrigerators. Available at: <https://united4efficiency.org/resources/>

- Trade industry representatives
- Consumer representatives
- Zambia Chamber of Commerce and Industry

In collaboration with the MoE and ZABS, the focal agency (ZCSA) will lead in developing and implementing the MEPS standards and labelling. ZABS will support ZCSA in developing specific technical standards to support regulations on minimum energy efficiency and safety. and MoE. ZCSA will work with ZRA at the border to administer and ensure compliance with the MEPS with compulsory standards on imported products. MoE will facilitate the identification and engagement of other necessary government agencies and key stakeholders and coordinate their effort and inputs.

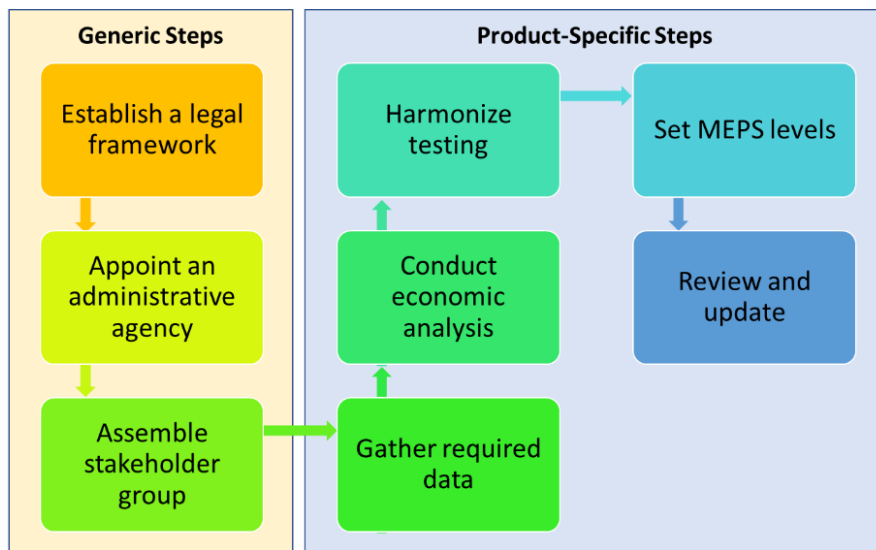


Figure 3-4: MEPS Development Framework

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

Table 3-3 lists actions for development of mandatory MEPS. It also includes country-specific activities that will support the future decision for MoE, ZCAS and ZABS to harmonize MEPS and testing methods with the SADC harmonised MEPS.¹⁸

Table 3-3: 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 | MoE, ZABS, ZCSA, and International/national advisor | 2023 |

¹⁸ 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

| | | |
|-------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|---------------|
| 2. Finalize the draft MEPS for voluntary implementation | ZCSA and ZABS | 2023 |
| 3. Establish/designate the Authority (preferably ZCSA) to regulate refrigerating appliances | MoE, and ZCSA | 2023 |
| 4. Develop and implement a capacity building and training program for ZCSA to effectively regulate the refrigerating products | MoE & International Partners | 2024 |
| 5. Conduct public consultation on the voluntary MEPS to become mandatory | ZCSA, ZABS, ZESCO, MoE, local manufacturers, and International/national advisor | 2024 |
| 6. Develop regulatory mechanism to enforce mandatory MEPS and testing method | MoE, ZCSA and ZABS | 2025 |
| 7. Promulgate the mandatory MEPS regulation | MoE/ZPPA/BRRA, Cabinet, and Parliament | 2025 |
| 8. Enforce the mandatory MEPS | MoE/ZCSA | 2026 |
| 9. Review and adjust the MEPS level based on the analysis of statistical data collected and the regional harmonisation trend | MoE/ZCSA/ZABS | Every 5 years |

3.2 Energy Labelling

3.2.1 Current Situation

Zambia has neither mandatory MEPS regulation nor the local manufacturer of residential refrigeration appliances. As mentioned, around 76% of the refrigerators sold in Zambia are imported from South Africa, and the market is already familiar with the South Africa refrigeration appliance energy label. The South Africa label is shown in Figure 3-5.

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.

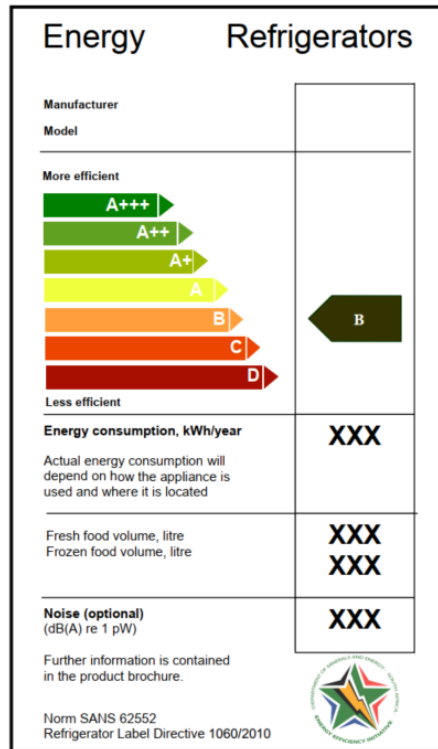


Figure 3-5: South African Residential Refrigerator Energy Efficiency Label

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 3-4.

Table 3-4: Correlation between Energy Efficiency Index and Energy Efficiency Level

| Energy Efficiency Index | 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.¹⁹ 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 Zambia/SADC specific label

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 Zambia/SADC Specific Label

It is essential to ensure that Zambia's MPES is harmonized regionally and between SADC countries (including Zambia) and South Africa for the medium to long term. The SADC/EAC MEPS suggests the use of 4 levels for energy efficiency levels²⁰ corresponding to the value of the energy consumption index, $R = AEC_{max}/AEC$, as follows:

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

Table 3-5: 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

¹⁹ UNEP/U4E: Energy labelling guidance for lighting and appliances. Available at: <https://united4efficiency.org/resources/>

²⁰ Additional levels of energy labelling requirement could also be incorporated in the future.

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 Zambian authorities such as ZCSA, ZABS and ZEMA, as shown in Figure 3-6. In addition, it should include the country of origin and refrigerant data as stated in the SADC/EAC MEPS.

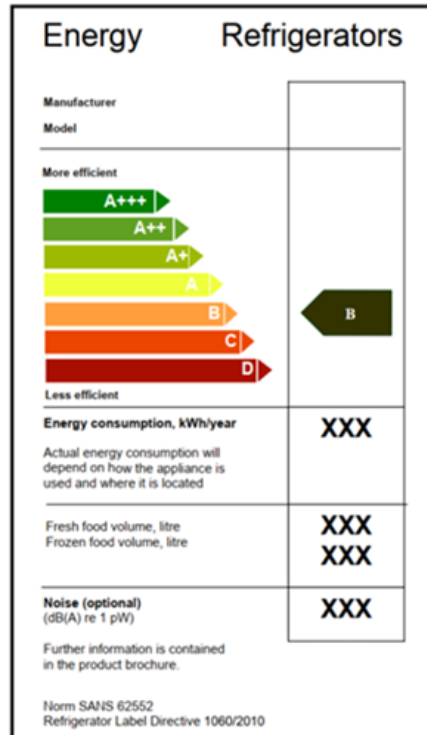


Figure 3-6: Zambia Specific Label carrying the Proper Seal of the Zambian Authorities

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

Table 3-6 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 3-6: 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. | MoE/ZCSA/ZABS | 2023 to 2024 |
| 2. Conduct market assessment to determine the initial impact of voluntary energy labelling implementation. | ZCSA/ZABS/ZRA/MoE | 2024 to 2025 |
| 3. Phase 2-Develop a uniform energy performance labelling for all residential refrigerators sold in Zambia (In coordination with the mandatory MEPS regulation) | ZCSA/ZABS/MoE | 2025 |
| 4. Develop a labelling regulation on requiring all residential refrigerators imported to and sold in Zambia be compliant with the mandatory labelling requirement | ZCSA/ZABS/ZRA/ZEMA/MoE | 2025 |

3.3 Communication Program

3.3.1 Current Situation

The consumer awareness about energy efficiency standards for refrigerators in Zambia is relatively low; almost 97% of consumers are unaware of the energy efficiency performance rating and labelling policies or schemes in Zambia. Based on residential user and supply chain interviews, energy efficiency was not a key purchasing decision driving factor; most sale drivers related appliance pricing and user monetary affordability. The survey indicates that the refrigerators market would still be influenced by the price of the appliance rather than its energy efficiency rating. Energy efficiency was not the key market driver for many energy-efficient products.²¹

²¹ Market Assessment Report on Residential Refrigerators and Distribution Transformers in Zambia, UNEP-CTCN GCF Readiness Project on “National framework for leapfrogging to energy efficiency appliances and equipment”, 2021.

Considering that energy-efficient refrigerators could cost more than 30% more than ordinary refrigerators, this poses a significant challenge for scaling up the adoption of energy efficiency and climate-friendly residential refrigerators into the market. Therefore, communication and awareness campaigns regarding energy-efficient appliances must be strengthened in Zambia.

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.

3.3.3 Actions & Timeframe

Table 3-7 lists key actions for implementing communication plan and consumer awareness and communication campaigns.

Table 3-7: Action Plan for Establishing Communication Plan and Consumer Awareness Campaign

| Action | Lead Agency & Other Stakeholders | Timeframe |
|--------|----------------------------------|-----------|
|--------|----------------------------------|-----------|

| | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|------------|
| 1. Develop awareness campaigns and capacity building program on new MEPS and labelling regulations | MoE/ZCSA | 2023 |
| 2. Conduct a training program for MoE, ZCSA, ZRA, ZABS, and relevant government agencies staff on evaluation and revision of the MEPS and labelling requirements. | International Advisor | 2025 |
| 3. Conduct a training program for ZESCO on managing and maintaining on-bill financing scheme | MoE, ZCSA, and International Advisor | 2025 |
| 4. Conduct a training program for in-store salespersons on understanding energy label and educating customers on the label usage and value | MoE, ZCSA, ZRA, Consumers Association of Zambia | 2025 |
| 5. Implement awareness campaigns for retailers/wholesalers/ distributors on MEPS and labelling regulations to manage inventories | MoE, ZCSA, ZRA, Consumers Association of Zambia | 2025 |
| 6. Conduct regular public awareness and education campaigns for consumers, and develop communication tools (incl. website, brochures, media reports, TV, and radio broadcasts, etc.) | MoE, ZCSA, ZRA and Consumers Association of Zambia | 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 30% compared to conventional products in Zambia, 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 Zambia bank loan terms and conditions. Lack of finances to effort new and efficient refrigerators were the highest rated barrier in Zambia.

Based on the residential survey in 2021 revealed that most user respondents (89%) find without a loan or the loan conditions unfavourable. Further, consumers have also indicated of high preference for access to financing; 63.7%% were willing to pay for an energy-efficient appliance but not more than 10% of the average cost of the appliance.

Considering the high up-front cost of energy-efficient refrigerators could be challenged to scale up the adoption of energy efficiency and climate-friendly residential refrigerators into the market. 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, microfinance institutions, National Development Bank (NDB), microfinance institutions, etc.) and participating EE technology providers (e.g., local retailers, local distributors, 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, NDB, the power utilities (ZESCO), as well as 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

On-bill financing scheme is recommended to facilitate end-users in the residential sector.

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 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 (ZESCO).

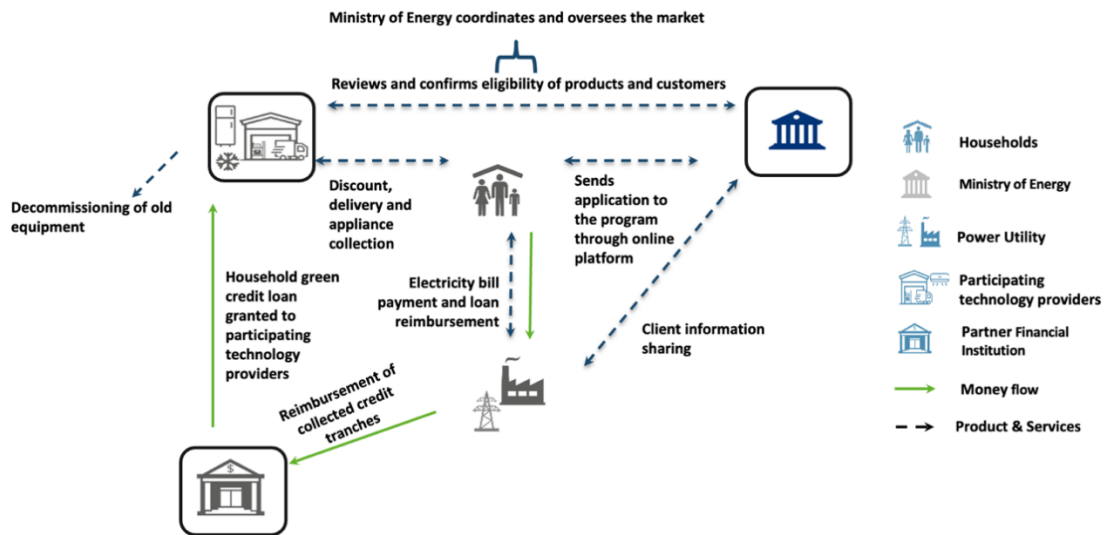


Figure 3-7: Recommended On-Bill Financing Scheme

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

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.

Involvement of key national stakeholders

To develop the financing strategies and financing scheme, MoE should consult and seek the potential partnership of interested financial institutions, 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 (MoE) acting as the lead compliance entity/program manager
- Other relevant government institutions (e.g., Ministry of Finance (MoFNP), Energy Regulatory Board (ERB), etc.)
- Power Utility (ZESCO)
- Partner financial institutions (e.g., banking institutions, microfinance institution, NDB, etc.)
- Partner technology providers of energy-efficient residential refrigerator (e.g., local retailers, local distributors, international manufacturers.)

3.4.3 Actions & Timeframe

Table 3-8 lists key actions for developing and implementing a supporting financial mechanism for energy-efficient residential refrigerators (See ANNEX F – Financing Mechanisms for Refrigerators details of the recommended implementation plan).

Table 3-8: Action Plan for Establishing and Implementing Financial Mechanisms for Refrigerators

| Action | Lead Agency & Other Stakeholders | Timeframe |
|---------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|--------------|
| 1. Finalize finance strategies and detailed implementation plan | MoE leads, with support from ERB and MoFNP | 2023 |
| 2. Engage potential donors and prepare technical assistance project proposals to turn the On-bill financing mechanism concept into programs | MoE | 2023 |
| 3. Develop and implement the On-bill financing mechanism program | MoE leads, with support from ERB and MoFNP, and technical assistance projects supported by international donors and experts. | 2024 |
| 4. Design and implement marketing campaigns to promote the financing mechanisms | MoE and ZESCO/financial institutions and technology providers | 2024 onwards |

3.5 Monitoring Verification and Enforcement

3.5.1 Current Situation

Although Zambia has not established a legislative and administrative framework to address non-compliance with MEPS and labelling requirements for electrical appliances, however, Zambia has a legal framework to certify and inspect compliance product with the electrical safety regulations. The current compliance and inspection activities are being carried out by ZCSA.

Rather than redesign a legal and administrative functions for MV&E implementation of the appliance MEPS and labelling programs, MoE, ZCAS, ZABS and ZRA will consider apply the existing regulatory framework for product compulsory standards and 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 Framework

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 3-9 provides a summary of MV&E components for the full implementation of MV&E actions for refrigerators in Zambia.

Table 3-9: Components of MV&E for Refrigerators

| MV&E Component |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Establishment and operation of a national MV&E system</p> <p>The following aspects to be considered:</p> <ul style="list-style-type: none"> • 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 |
| <p>Establishment of a national registry system for refrigerators</p> <p>The following aspects to be considered:</p> <ul style="list-style-type: none"> • 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 |
| <p>Establishment of communication program to promote compliance activities</p> <p>The following aspects to be considered:</p> <ul style="list-style-type: none"> • Main stakeholders involved in the supply chain • Key messages – compliance requirements, the risk of detection and sanctions |
| <p>Establishment of market surveillance program for refrigerators</p> <p>The following aspects to be considered:</p> <ul style="list-style-type: none"> • Approaches to checking markets for non-compliance (e.g., risk-based and random sampling) • Procedures for applying penalties for non-compliance cases |
| <p>Establishment of verification testing program for refrigerators</p> <p>The following aspects to be considered:</p> <ul style="list-style-type: none"> • 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 |
| <p>Establishment of evaluation program for mandatory MEPS and labelling program for refrigerators</p> <p>The following aspects to be considered:</p> |

- MEPS registration & certification process and compliance

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 3-10.

Table 3-10: 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 | MoE (lead), ZCSA, ZRA/MoFNP | Draft by end of 2023 and full enforcement by 2024 |
| Develop administrative procedures/ operational manual for enforcing regulations on MEPS and labelling program | MoE (lead), ZCSA, ZABS, ZRA/Customs | 2023 |
| Assess and conduct capacity building on national MV&E mechanism for responsible staff (customs and other related-MV&E officials) | MoE/ZCSA/ZRA | 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 | MoE/ZCSA/ZRA/ERB | 2024 |
| Train responsible officers in charge of management and maintenance of PRS | MoE/ZCSA/ZRA | 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 | MoE (lead), ZCSA, ZRA/MoFNP, Customs | Draft by end of 2023 and full enforcement by 2024 |
| Develop national regulations on mandatory registration of refrigerators | MoE | 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 | MoE/ZCSA/ZRA | 2023 |
| Develop information materials for custom officials and consumers | MoE/ZCSA/ZRA | 2023 |
| Train importers on mandatory registration of regulated refrigerator products and their legal obligations | MoE/ZCSA/ZRA | 2023 |
| Develop and publish annual reports to maintain market transparency and declare non-compliance cases | MoE/ZCSA/ZRA | 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 | MoE/ZCSA/ZBAS/ ZRA | Draft by the end of 2023 and full operation on annual basis by 2024 |
| Train officers in charge of market surveillance | MoE/ZCSA/ZRA | 2023 |
| Implement pilot market surveillance program and evaluate the results for full application deployment | MoE/ZCSA and ZRA | 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 | MoE, ZCSA and ZRA | 2024 |
| Implement pilot verification testing program and evaluate the results for full application deployment | MoE, ZCSA and ZRA | 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 | MoE/ZCSA and ZRA | 2025 and periodic assessment throughout the program |

4 Distribution Transformers

The distribution transformer market supplier in Zambia has only a few players, mainly dependent on the buyer of the transformer. Predominantly the power utilities, mining companies, and related industries are procuring distribution transformers. The supply chain involves both locally manufactured and imported transformers. Most of DTs in Zambia are imported with few local manufacturers supplying small size DTs as well as providing repairing services.

There are five key suppliers/manufacturers in Zambia: Elsewedy Transformers, AFRIZAM Electrical Limited, Tanelec Zambia Limited, Marthinusen and Coutts, and Eugene Lottering. Most transformers in Zambia are manufactured in or distributed by South African companies, with roughly 69% coming from South Africa. There are also some business ties along with competitive pricing of India and China suppliers/distributors, increased market share of imports transformer those two countries. The DT market in Zambia is segmented by Insulation type (Oil-filled and Dry-type), Mounting type (Pad-Mounted and Underground vault) and by Phase. The typical types of transformers available on the Zambian market include distribution transformers up to 36 kVA and oil immersed distribution transformers from 25 kVA up to 4000 kVA with a primary voltage up to 33 kV.

The power network in Zambia is owned and operated by ZESCO, the national power utility. Zambia has over 400 substations in the transmission system countrywide with step-down capacities of 330/132 kV, 132/33 kV, or 33/11 kV, while in the distribution system, there are an estimated above 19,000 distribution transformers with a step-down capacity of 33/0.4 kV and 11/0.4 kV on the network. ZESCO is responsible for the operations and maintenance of these transformers.

The government has spelled out the country's plans to increase the electrification rate to 80% at the national level by 2030, and the Rural Electrification Master Plan (REMP) targets increasing the electrification rate in rural areas from 3% to 51% by the year 2030. The Plan has identified a total of 1,217 Growth Centers in rural areas throughout the country, which will be the target for electrification from 2008 to 2030. This will mean an extension of the national electricity grid and the installation of more distribution transformers on the network.

The market size for new DTs is estimated based on the need to replace the old ones at the end of their life span, to replace them due to theft, and to meet the growth in demand for electricity. Based on the U4E Country Saving Assessment, the current estimated stock of DT is 19,000 units, and Zambia has strong commitments towards increasing the electrification rates from 40% to 80% by 2030. The expected an ambitious growth in the DT stocks, as shown in Figure 4-1.²²

The current electric power transmission and distribution losses represent 15% of Zambia's electricity generation output, almost double the losses in South Africa.²³ Based on the U4E Country Saving Assessment, adopting a higher energy efficiency distribution transformer in Zambia may result in 50 to 79 GWh of annual energy saving by 2030, equivalent to 60 to 94 thousand tonnes of CO_{2eq} emission avoided and 2.2 to 3.64 million USD saving in energy bills.²⁴

²² Market Assessment Report on Residential Refrigerators and Distribution Transformers in Zambia, UNEP-CTCN GCF Readiness Project on "National framework for leapfrogging to energy efficiency appliances and equipment", 2021.

²³ <https://data.worldbank.org/indicator/EG.ELC.LOSS.ZS?locations=ZM>

²⁴ <https://united4efficiency.org/country-assessments/zambia/>

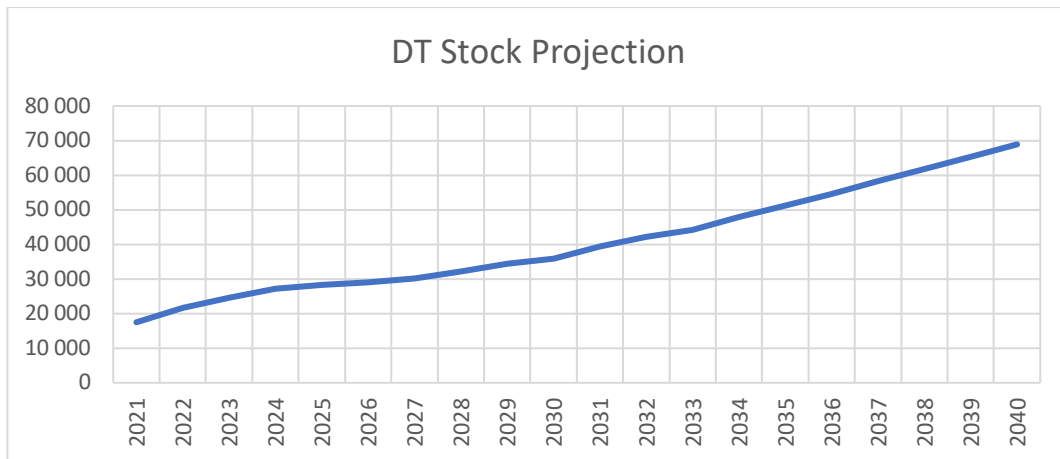


Figure 4-1: DT Stock Projection under BAU Scenario

4.1 Minimum Energy Performance Standards

4.1.1 Current Situation

Through the Energy Regulation Board, Zambia established the Power Distribution Grid Code in 2018.²⁵ It designs to provide clear procedures for planning and operational purposes, to ensure efficient development, operation, and maintenance of a coordinated and economic power distribution system, and to promote grid integration of renewable energy technologies. It further promotes the use of both international and national technical standards for distribution transformers.

ZESCO’s utility standard procurement specification for DTs, in some cases, reflects both aspects of safety and energy efficiency for distribution transformers, such as maximum losses or minimum efficiency applying the South Africa Standards in most cases, the SANS 780 on Distribution transformers. The IEC-60076 series, which includes safety standards for power transformers and other IEC-related standards, have also been adopted through the National standards body ZABS, as shown in Table 4-1. However, Zambia has no mandatory minimum energy performance standards MEPS for distribution transformers, and the country does not have a labelling scheme to differentiate between transformers' performances.

Table 4-1: List Adopted Standards on Transformers and Related

| Standard | Title of the Standard |
|----------------------------|-----------------------------------------------------------|
| IEC 60694:1,2,3,4,5,6,7,8 | Low Voltage Switchgear and control gear |
| IEC 62271-1:2017 | The whole Series of Standards on High voltage Switchgears |
| IEC 60439-1,2,3,4,5: | Low Voltage Switchgears |
| IEC 62626-1:2014: | Low-voltage switchgear and control gear |
| SANS 725:2010/IEEE 80:2000 | IEEE guide for safety in AC substation grounding |

²⁵ ERB, 2018

| | |
|---------------------------------------------------------------------------------|--------------------------------------|
| IEC 60044-7, 8:1999: | Instrument transformers Part 7 and 8 |
| IEC 60076-2, 3, 4, 5, 6, 7, 8,9, 10, 11, 12, 13, 14, 15, 16, 18, 19, 20, 21, 57 | Power Transformers |
| COMESA 310-1,2,3:2010 | Convertor transformers |

4.1.2 Recommended MEPS

Many countries and regions have adopted all, parts, or modified versions of the “IEC 60076 series - Power transformers”²⁶ 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 Zambia through ZESCO, CEC and related industry mining companies. The current electric power transmission and distribution losses represent 15% of output in Zambia. 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 Zambia.

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 4-2. 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 4-2. however, considering the Load and No-Load losses can capture the difference in performance under both the realistic and worst-case DT loading scenarios.

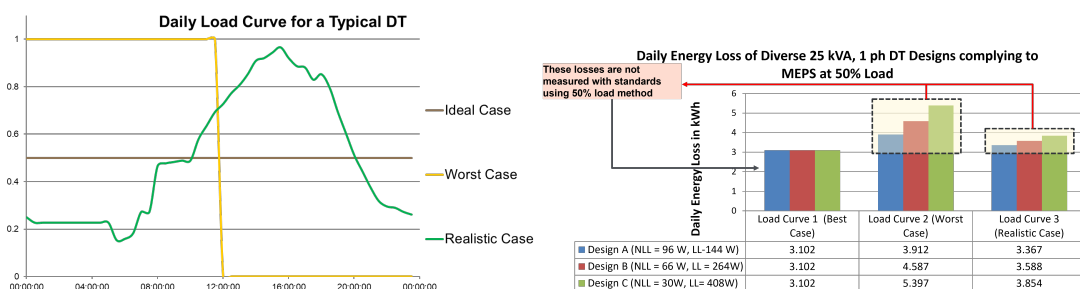


Figure 4-2: Energy loss in DTs based on usage pattern.

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

²⁶ <https://webstore.iec.ch/publication/588>

780:2021. Considering this, it is recommended for ZCSA and ZESCO 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 Zambia, 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 Zambia 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 Zambia.

- **Step 1** – The Government of Zambia should consider adoption of SANS 780:2021 as the initial MEPS for DTs in Zambia and ZESCO to reference the maximum LL/NLL specified in SANS 780:2021 in its procurement specifications. This step would essentially move Zambia closer to IEC 60076-20 Level 1 efficiency requirements. Zambia 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 following timelines for implementation of the abovementioned steps of MEPS adoption was recommended in the 2nd Technical committee meeting (TC-DT) on 23rd June 2022, as summarized below.

- **Step 1** – one (1) year after adoption of MEPS or by 1st July 2023 whichever is sooner (MEPS equivalent to SANS 780:2021)²⁷
- **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)

There was a consensus from the Technical Committee that accepted the U4E model regulation. Adopting Step 1 of SAN 780:2021, there is a need to do an impact assessment and consult with the Zambia Public Procurement (ZPPA). On the adoption of MEPS levels, there is a need to consult with the key stakeholders in the industry to review the levels of MEPS.

²⁷ Adopting Step 1 of SAN 780:2021, there is a need to consult with the Zambia Public Procurement (ZPPA), and ZPPA will be invited to be member of the sub-committee and to do an impact assessment.

Zambia will organize an additional public consultation to conclude the adoption of MEPS levels.

4.1.3 Actions & Timeframe

The overall responsibility of the NPR implementation and MEPS regulation lies with the MoE to establish a legal framework and guidance on policy and execution. The Zambian Authority may wish to consider ZCSA to be the custodian of DT MEPS and consider adopting the proposed regional U4E model regulation. Other key government agencies that will support the implementation of DT MEPS within the scope identified by their mandate include the ZABS, ZESCO, ERB, ZRA, and ZPPA.

As DT MEPS levels have already been specified in regional and international standards, Table 4-2 lists actions for adoption of appropriate DT MEPS. It also includes country-specific activities that will support the future decision for ZCSA, ZABS, ZESCO and MoE to harmonize MEPS and testing methods with the SADC/EAC MEPS.

Table 4-2: Action plan for Adoption of DT MEPS in Zambia

| Actions | Lead Agency & Other Stakeholders | Timeframe |
|------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|---------------|
| 1. Develop an implementation plan on the national policy roadmap | MoE (lead), ZCSA, ZABS, ZESCO, ZPPA, MoE, ERB and International/national advisor | 2023 |
| 2. Finalise the draft MEPS for voluntary Implementation | ZCSA (lead), ZABS, ZESCO, MoE, ZPPA, and relevant stakeholders | 2023 |
| 3. Establish/designate the Authority (preferably ZCSA) to regulate DTs | TWG and International/national advisor | 2023 |
| 4. Conduct a capacity-building program for regulated staff and other identified stakeholders (local manufacturers) | ZCSA, ZABS, ZESCO, MoE, local manufacturers, and International/national advisor | 2024 |
| 5. Conduct public consultation on the voluntary MEPS to become mandatory | ZCSA (lead), ZESCO, ZABS, ZPPA, MoE, and International/national advisor | 2024 |
| 6. Develop a regulatory mechanism to enforce and implement mandatory MEPS and the testing method | MoE, ZCSA, ZABS | 2025 |
| 7. Promulgate the mandatory MEPS | MoE/ZPPA/BRRA, Cabinet, and Parliament | 2025 |
| 8. Enforce the mandatory DTs MEPS | ZCSA/MoE | 2026 |
| 9. Review and adjust the MEPS level based on the analysis of statistical data collected and the regional harmonisation trend | ZESCO lead enforcement of DT MEPS | Every 5 years |

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 worldwide²⁸ implementing energy labelling programs for DTs. As for Zambia, ZCSA should adopt the IEC 60076-1 into the list of standards, and ZESCO should specify the labelling requirements for DTs as per the IEC 60076-1 nameplate specifications for bidding. Hence LL and NLL information should be available for designers and end-users to evaluate and compare efficiency of DTs. Considering this, an energy labelling scheme for DTs in Zambia is not considered as a priority action under the proposed national policy roadmap.

4.3 Communication Program

4.3.1 Current Situation

ZESCO Limited invites sealed bids through open international competitive bidding process for the supply and delivery of substation equipment in line with the national procurement procedures specified in the Public Procurement Act of 2008 and the Public Procurement Regulations of 2011. Typically, this bidding process would specify a schedule of requirements with relevant technical standards to be met including maximum losses or minimum efficiency applying the South Africa Standards in most case the SANS 780. The IEC-60076 series which includes safety standards for power transformers and other IEC related standards have also been adopted through the National standards body ZABS.

Regarding energy efficiency, the specifications require routine tests by the manufacturer to include No Load Losses (NLL) and Load Losses (LL) compliant with IEC 60076-1 standard on Power Transformers – Part 1: General. Bidders should be able to provide test certificates which indicate, among other parameters, the NLL and LL. The energy efficiency criteria are based on the capitalization of losses per A and B factors for capitalization of losses as show in Table 4-3.

Table 4-3: A and B Factors for Different Transformer Types

| Rating (kVA) | 33kV Transformers | | 11kV Transformers | |
|-----------------|---------------------|---------------------|---------------------|---------------------|
| | A Factor (\$/kW) | B Factor (\$/kW) | A Factor (\$/kW) | B Factor (\$/kW) |
| 50 | 7,600 | 2,100 | 7,600 | 2,100 |
| 100 | 7,600 | 2,500 | 7,600 | 2,500 |
| 200 | 7,600 | 2,500 | 7,600 | 2,500 |
| 315 | 7,600 | 2,500 | 7,600 | 2,500 |
| 500 | 7,600 | 3,000 | 7,600 | 3,000 |
| 800 | 7,600 | 3,400 | 7,600 | 3,400 |
| 1000 | 7,600 | 3,400 | 7,600 | 3,400 |

²⁸ China, India, Japan, Mexico, Republic of Korea, and USA

4.3.2 Recommended Communication Plan

Once the MEPS recommendations are adopted, the public procurement guidelines for DTs must be updated. ZESCO 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 Zambia, 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:

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

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

| Message: | Tools Available: |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> • 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 | <ul style="list-style-type: none"> • U4E TCO ²⁹ • Utilities informational content • Transformer manufactures content/data • Articles in electrical engineering magazines |

²⁹ <https://united4efficiency.org/resources/a-guide-to-using-total-cost-of-ownership-when-purchasing-distribution-transformers/>

| | |
|----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| Ownership (TCO) while ensuring reliability? | <ul style="list-style-type: none"> 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 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: |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> 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? | <ul style="list-style-type: none"> 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: |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> • What is the right transformer for you? (LCA vs. TCO) • What is energy loss? “Load/No-Load Losses” | <ul style="list-style-type: none"> • U4E TCO²⁹ • 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. |

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 | ZCSA, ZABS, ZESCO, MoE, and 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 | ZCSA, ZABS, ZESCO, MoE, International/ national advisor, and relevant stakeholders | 2024 |

4.4 Financing Mechanisms

4.4.1 Current Situation

Through its electrification plan and the rural authority, the Zambia government has spelled out the Rural Electrification Master Plan (REMP), which has set an ambitious target for increasing access to electricity by 2030. This means an extension of the national electricity grid and the installation of more distribution transformers on the network. The REMP plan has identified a total of 1,217 Growth Centers in rural areas throughout the country during the period 2008 to 2030. The growth centers are planned to be electrified using three principal

methods of electrification, namely grid extension (extending the existing national grid), Stand-alone electricity systems supplied from renewable sources such as Mini Hydro Power Stations and Biomass Generation and Solar Energy. The total investment required to achieve this target is USD 1.1 billion, this translates into an annual expenditure of USD 50 million. However, the Supporting Programmes or Financial Mechanism such as voluntary programmes, tax breaks, procurement specifications, labelling, or other incentives that promote energy-efficient units are not available in Zambia.³⁰

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., MDBs, NDB, green funds, local banking institutions, etc.). If a green loan is granted from a financing 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.

³⁰ Market Assessment Report on Residential Refrigerators and Distribution Transformers in Zambia, UNEP-CTCN GCF Readiness Project on "National framework for leapfrogging to energy efficiency appliances and equipment", 2021.

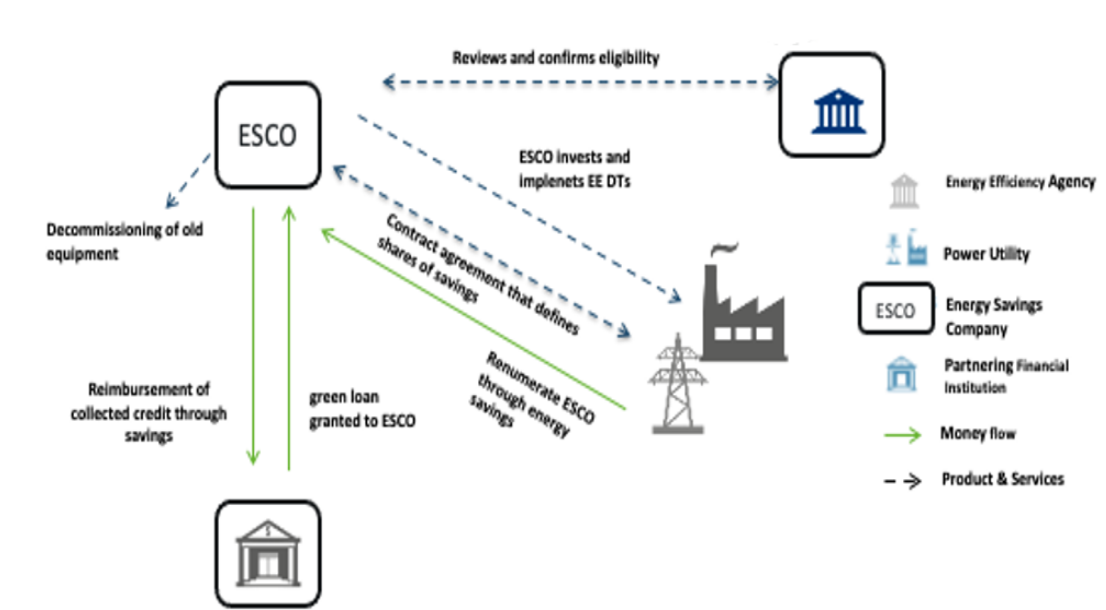


Figure 4-3: Recommended ESCO EPC - shared savings model scheme

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., MDBs, 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

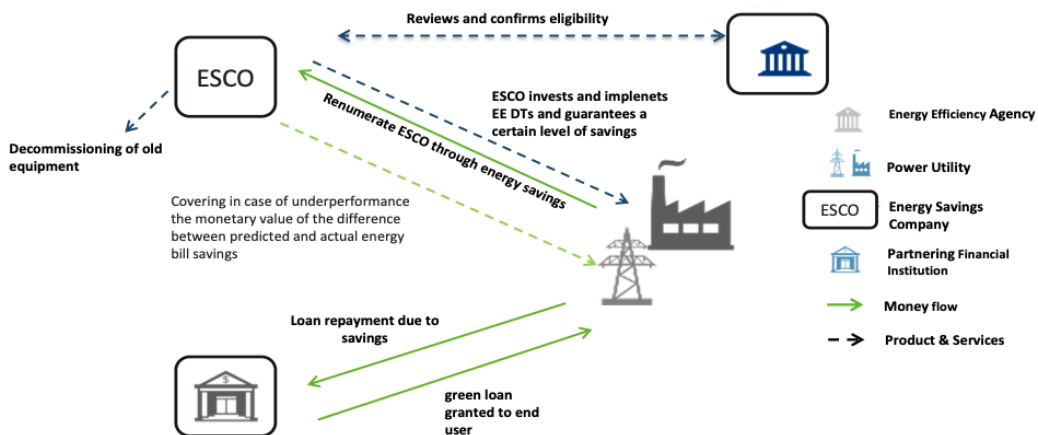


Figure 4-4: Recommended ESCO EPC - guaranteed savings model scheme

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 issues 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.

- MoE acting as the lead compliance entity/program manager
- Other relevant government institutions (e.g., ERB, ZABS, ZCSA, MoFNP, ZPPA, etc.)
- Partner ESCOs and/or participating technology providers (e.g., manufacturers and distributors of EE distribution transformers, local or international manufacturers, etc.)
- Power Utility (ZESCO) 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.

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 | MoE leads, and ZESCO, ERB, MoFNP, ZABS, ZCSA, ZPPA, and international/national advisor | 2023 |
| 2. Engage potential donors and prepare technical assistance project proposals for the proposed financial mechanisms | MoE and International/national advisor | 2023 |
| 3. Develop and implement the proposed financing mechanisms through technical assistance projects supported by international donors and experts | MoE leads, with support from ZESCO, ERB, ZABS, ZCSA, MoFNP, ZPPA, and with technical assistance projects supported by international donors and experts. | 2024 |

| | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|--------------|
| 4. Seek and develop partnerships with financial Institutions and ZESCO including T&C and agreements signing for the proposed financing mechanisms | MoE and ZESCO/financial institutions | 2024 |
| 5. Assess eligibility and negotiate with ESCOs and/or technology providers, including MOU signing | MoE and ZESCO/ESCOs/technology providers | 2024 |
| 6. Implement marketing and promotion strategy and activities to promote the pilot demonstration program(s) | MoE and ZESCO/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 conducting MV&E for DTs in Zambia, and witness testing at the factory is only conducted for verification testing for large power transformers (greater than 1000 kVA) or for a large procurements of distribution transformers larger than 315 kVA. DTs with lower capacities are typically approved with test certificates. For these tests, engineers can witness the tests; the results are then made available for evaluation before delivery of the distribution transformers. Manufacturers may provide either type or special tests on one transformer of each size or provide certificates of previous tests done on identical transformers.

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 Zambia.

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

| MV&E Component |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Establishment and operation of a national MV&E system</p> <p>The following aspects to be considered:</p> <ul style="list-style-type: none"> • 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 |
| <p>Establishment of a national registry system for distribution transformers</p> <p>The following aspects to be considered:</p> <ul style="list-style-type: none"> • 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

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 | MoE, ZCSA, ZABS, ZRA, ZESCO, ERB, ZPPA | Draft by end of 2023 and full enforcement by 2024 |
| 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 | MoE, ZCSA, ZABS, ZRA, ZESCO | 2023 |
| Develop administrative procedures/ operational manual for enforcing regulations on MEPS program | MoE, ZCSA, ZABS, ZRA, ZESCO | 2023 |
| Establishment of a national registry system for distribution transformers | | |
| Develop a product registration system (PRS) for distribution transformers | MoE, ZCSA, ZRA, ZESCO | 2024 |
| Train responsible officers in charge of management and maintenance of PRS | MoE, ZCSA, ZRA, ZESCO | 2023 |
| Develop national regulations on mandatory registration of distribution transformers | MoE, ZCSA, ZRA, ZESCO | 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 | MoE/ZCSA/ZRA | 2023 |
| Develop information materials on regulatory compliance requirements and obligations (e.g., procedures to obtain registrations and import permits) | MoE/ZCSA/ZRA | 2023 |
| Develop and publish annual reports to maintain market transparency and declare non-compliance cases for manufacturers, distributors, power utilities, and end users | MoE/ZCSA/ZRA | 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. | MoE/ZCSA/ZRA | 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 ZESCO's staff.

5.1.1 Refrigerators

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

| Action No. | Action | Lead Agency & Other Stakeholders | Timeframe | Budget (US\$) |
|------------|----------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|-----------|---------------|
| A | MEPS | | | |
| A.1 | Develop an implementation plan on national policy roadmap | MoE, ZABS, ZCSA, and International/ national advisor | 2023 | 105,600 |
| A.2 | Finalize the draft MEPS for voluntary implementation | ZCSA and ZABS | 2023 | 35,200 |
| A.3 | Establish/designate the Authority (preferably ZCSA) to regulate refrigerating appliances | MoE, and ZCSA | 2023 | 158,400 |
| A.4 | Develop and implement a capacity building and training program for ZCSA to effectively regulate the refrigerating products | MoE & International Partners | 2024 | 35,200 |
| A.5 | Conduct public consultation on the voluntary MEPS to become mandatory | ZCSA, ZABS, ZESCO, MoE, local manufacturers, and International/national advisor | 2024 | 52,800 |
| A.6 | Develop regulatory mechanism to enforce mandatory MEPS and testing method | MoE, ZCSA and ZABS | 2025 | 105,600 |

| Action No. | Action | Lead Agency & Other Stakeholders | Timeframe | Budget (US\$) |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|---------------|-----------------|
| A.7 | Promulgate the mandatory MEPS regulation | MoE/ZPPA/BRRA, Cabinet, and Parliament | 2025 | Included in A.6 |
| A.8 | Enforce the mandatory MEPS | MoE/ZCSA | 2026 | 50,000 |
| A.9 | Review and adjust the MEPS level based on the analysis of statistical data collected and the regional harmonisation trend. | MoE/ZCSA/ ZABS | 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.. | MoE/ZCSA/ZABS | 2023 to 2024 | 35,200 |
| B.2 | Conduct market assessment to determine the initial impact of voluntary energy labelling implementation. | ZCSA/ZABS/ZRA/MoE | 2024 to 2025 | 35,200 |
| B.3 | Phase 2-Develop a uniform energy performance labelling for all residential refrigerators sold in Zambia (In coordination with the mandatory MEPS regulation) | ZCSA/ZABS/MoE | 2025 | 70,400 |
| B.4 | Develop a labelling regulation on requiring all residential refrigerators imported to and sold in Zambia be compliant with the mandatory labelling requirement | ZCSA/ZABS/ZRA/ZEMA/MoE | 2025 | 70,400 |
| C | Communication Program | | | |
| C.1 | Develop awareness campaigns and capacity building program on new MEPS and labelling regulations | MoE/ZCSA | 2023 | 26,400 |
| C.2 | Conduct a training program for MoE, ZCSA, ZRA, ZABS, 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 ZESCO on managing and maintaining on-bill financing scheme | MoE, ZCSA, and International Advisor | 2025 | 35,200 |
| C.4 | Conduct a training program for in-store salespersons on understanding energy label and educating customers on the label usage and value | MoE, ZCSA, ZRA, Consumers Association of Zambia | 2025 | 44,000 |

| Action No. | Action | Lead Agency & Other Stakeholders | Timeframe | Budget (US\$) |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|-------------------------|
| C.5 | Conduct a training program for in-store salespersons on understanding energy label and educating customers on the label usage and value | MoE, ZCSA, Consumers Association of Zambia | 2025 | Included in C.4 |
| C.6 | Conduct regular public awareness and education campaigns for consumers, and develop communication tools (incl. website, brochures, media reports, TV, and radio broadcasts, etc.) | MoE, ZCSA, ZRA and Consumers Association of Zambia | Every year | 50,000 |
| D | Financing Mechanisms | | | |
| D.1 | Finalize finance strategies and detailed implementation plan | MoE leads, with support from ERB and MoFNP | 2023 | 35,200 |
| D.2 | Engage potential donors and prepare technical assistance project proposals to turn the On-bill financing mechanism concept into a program | MoE | 2023 | 35,200 |
| D.3 | Develop and implement the On-bill financing mechanism program | MoE leads, with support from ERB and MoFNP, 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 On-bill financing mechanism | MoE and ZESCO/ 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 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 | MoE (lead), ZCSA, ZRA/MoFNP | Draft by end of 2023 and full enforcement by 2024 | 158,400 |
| E.2 | Develop administrative procedures/ operational manual for enforcing regulations on MEPS and labelling program | MoE (lead), ZCSA, ZABS, ZRA/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) | MoE/ZCSA/ZRA/ERB | 2023 | 57,800 |

| Action No. | Action | Lead Agency & Other Stakeholders | Timeframe | Budget (US\$) |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------|-----------------|
| E.4 | 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 | MoE/ZCSA/ZRA | 2024 | 65,200 |
| E.5 | Train responsible officers in charge of management and maintenance of PRS | MoE/ZCSA/ZRA | 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 | MoE (lead), ZCSA, ZRA/MoFNP, 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 | MoE | 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 | MoE/ZCSA/ZRA | 2023 | 17,600 |
| E.9 | Develop information materials for custom officials and consumers | MoE/ZCSA/ZRA | 2023 | 27,600 |
| E.10 | Train importers on mandatory registration of regulated refrigerator products and their legal obligations | MoE/ZCSA/ZRA | 2023 | 17,600 |
| E.11 | Develop and publish annual reports to maintain market transparency and declare non-compliance cases | MoE/ZCSA/ZRA | 2023 | Included in E.8 |
| E.12 | Establish a methodology for identification of products selected and purchase for verification processes, allocate staff for verification (Market Surveillance) and implement | MoE/ZCSA/ZBAS/ZRA | Draft by the end of 2023 and full operation on annual basis by 2024 | 26,400 |



| Action No. | Action | Lead Agency & Other Stakeholders | Timeframe | Budget (US\$) |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-----------------------------------------------------|------------------|
| E.13 | Train officers in charge of market surveillance | MoE/ZCSA and ZRA | 2023 | Included in E.14 |
| E.14 | Implement pilot market surveillance program and evaluate the results for full application deployment | MoE/ZCSA and ZRA | 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 | MoE, ZCSA and ZRA | 2024 | Included in E.14 |
| E.16 | Implement pilot verification testing program and evaluate the results for full application deployment | MoE, ZCSA and ZRA | 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 | MoE/ZCSA and ZRA | 2025 and periodic assessment throughout the program | 17,600 |
| | | | TOTAL | 1,820,200 |

5.1.2 Distribution Transformers

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

| Action No. | Action | Lead Agency & Other Stakeholders | Timeframe | Budget |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|-----------|----------|
| F | MEPS | | | |
| F.1 | Develop an implementation plan on the national policy roadmap | MoE (lead), ZCSA, ZABS, ZESCO, ZPPA, ERB , and International/ national advisor | 2023 | 105,600 |
| F.2 | Finalise the draft MEPS for voluntary Implementation | ZCSA (lead), ZABS, ZESCO, MoE, ZPPA and relevant stakeholders | 2023 | 35,200 |
| F.3 | Establish/designate the Authority (preferably ZCSA) to regulate DTs | TWG and International/ national advisor | 2023 | 35,200 |
| F.4 | <p>Conduct a capacity-building program for regulated staff and other identified stakeholders (local manufacturers)</p> <p>Description: Budget for a capacity-building program covering all aspects of the EE policy implementation and transitioning to the regulated MEPS for local manufacturers:</p> <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> ○ 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 | ZCSA, ZABS, ZESCO, MoE, local manufacturers, and International/national advisor | 2024 | 399,200* |

| | | | | |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|---------------|-----------------|
| | 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 | ZCSA (lead), ZESCO, ZABS, ZPPA, MoE, and International/ national advisor | 2024 | 35,200 |
| F.6 | Develop a regulatory mechanism to enforce and implement mandatory MEPS and the testing method | MoE, ZCSA, ZABS | 2025 | 35,200 |
| F.7 | Promulgate the mandatory MEPS | MoE/ZPPA/BRRA, Cabinet, and Parliament | 2025 | Included in F.3 |
| F.8 | Enforce the mandatory DTs MEPS | ZCSA/MoE | 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 | ZESCO lead enforcement of DT MEPS | Every 5 years | 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 | ZCSA, ZABS, ZESCO, MoE, and 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 | ZCSA, ZABS, ZESCO, MoE, International/ national advisor, and relevant stakeholders | 2024 | 27,600 |
| H | Financing Mechanisms | | | |
| H.1 | Establish finance/procurement strategies and detailed implementation plan for each financing mechanism | MoE leads, with support from ZESCO, ERB, ZCSA, ZABS, MoFNP, and ZPPA, and international/ national advisor | 2023 | 35,200 |
| H.2 | Engage potential donors and prepare technical assistance project proposals for the proposed financial mechanisms | MoE 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 | MoE leads, with support from ZESCO, ZCSA, ZABS, ERB, MoFNP, ZPPA, 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 ZESCO including T&C and agreements signing for the proposed financing mechanisms | MoE and ZESCO/financial institutions | 2024 | Included in H.3 |
| H.5 | Assess eligibility and negotiate with ESCOs and/or technology providers, including MOU signing | MoE and ZESCO/ESCOs/technology providers | 2024 | Included in H.3 |
| H.6 | Implement marketing and promotion strategy and activities to promote the pilot demonstration program(s) | MoE and ZESCO/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 | MoE (lead), ZCSA, ZABS, ZRA, ZESCO, ERB, ZPPA | 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 the national MV&E framework and harmonization of the DT product registry | MoE, ZCSA, ZABS, ZRA, ZESCO | 2023 | 35,200 |
| I.3 | Develop administrative procedures/ operational manual for enforcing regulations on the MEPS program | MoE, ZCSA, ZABS, ZRA, ZESCO | 2023 | 35,200 |
| I.4 | Develop a product registration system (PRS) for distribution transformers | MoE, ZCSA, ZRA, ZESCO | 2024 | 65,200 |
| I.5 | Train responsible officers in charge of management and maintenance of PRS | MoE, ZCSA, ZRA, ZESCO | 2023 | 8,800 |
| I.6 | Develop national regulations on mandatory registration of distribution transformers | MoE, ZCSA, ZRA, ZESCO | Draft by end of 2023 and full | Included in I.1 |



| | | | enforcement by 2024 | |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----------------------------------------------------|------------------|
| I.7 | Design communication plan for DT suppliers, customs, and other stakeholders on enforcement obligations | MoE/ZCSA/ZRA | 2023 | 17,600 |
| I.8 | Develop information materials on regulatory compliance requirements and obligations (e.g., procedures to obtain registrations and import permits) | MoE/ZCSA/ZRA | 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 | MoE/ZCSA/ZRA | 2023 | Included in I.6 |
| I.10 | Plan and implement the evaluation program on MEPS registration & certification process, compliance and impact | MoE/ZCSA/ZRA | 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.

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Minutes of Zambia's Policy Working Group Meetings

Minutes of Zambia's Technical Working Group Meetings for Refrigeration and Distribution.

7 Annexes

7.1 ANNEX A – Members of the Policy Work Group

Michael Mulasikwanda- Ministry of Energy (MoE),-Focal Point—PWG Chairperson

Marvin Mumba –Ministry of Energy (MoE)

Aubbrey Ndandula–Zambia Revenue Authority (ZRA)

Florence Simumba-Ministry of Water Development, Sanitation and Environmental Protection (MWDSEP)

Francis Mpampi- Ministry of National Development and Planning (MNDP) – i.e., National Designated Authority (NDA)

Jane Chikusu- Ministry of Higher Education (MoHE), Department of Science and Technology (DST)

Ben Makayi- Representative from Ministry of Higher Education,-i.e., National Designated Entity (NDE) Focal Point

Nkumbu Zyambo- Representative from the Ministry of Finance and National Planning (MoFNP)

Charity Banda-Representative from the Ministry of Commerce, Trade and Industry (MCTI)

Allen Polito-Energy Regulation Board (ERB)

Daisy Michelo-Zambia Electricity Supply Corporation (ZESCO Limited)

Chilufya Sampa-Competition and Consumer Protection Commission (CCPC)

Reevon Mulongo-Transformco Power Services, Zambia Association of Manufacturers (ZAM)

PJ Sudhir-Zambia Chamber of Commerce and Industry (ZACCI)

Patrick Zimba-Zambia Compulsory Standards

C Kasase-National Designated entity (NDE), Ministry of education

Belinda Kancheya-Zambia Bureau of Standards (ZABS)

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

Allen Chivunda –Ministry of Energy (MoE)

Alfred Phiri–Zambia Revenue Authority (ZRA)

Florence Simumba-Ministry of Water Development, Sanitation and Environmental Protection (MWDSEP)

Francis Mpampi- Ministry of National Development and Planning (MNDP) – i.e., National Designated Authority (NDA)

John L Chongo- Ministry of Higher Education (MoHE), Department of Science and Technology (DST)

Ben Makayi- Representative from Ministry of Higher Education-i.e., National Designated Entity (NDE) Focal Point

Brian Mainza Ministry of Energy (MoE)

Moses Ngosa -Representative from the Ministry of Commerce, Trade and Industry (MCTI)

Allen Polito-Energy Regulation Board (ERB)

Daisy Michelo-Zambia Electricity Supply Corporation (ZESCO Limited)

Chilufya Sampa-Competition and Consumer Protection Commission (CCPC)

Reevon Mulongo-Transformco Power Services-Zambia Association of Manufacturers (ZAM)

Emmanuel chilufya-Zambia Chamber of Commerce and Industry (ZACCI)

Shakir Shah-South Gate

Kasuba Kasengele-Zambia Compulsory Standards

C Kasase-National Designated entity (NDE), Ministry of education

Innocent Mandona-National Technology Business Centre

Chikoma Mwansa -Zambia Bureau of Standards (ZABS)

Mwembela-Zambia Environmental Management Agency

Wilson-Northwestern Energy Corporation

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

Brian Sinkala Mainza –Ministry of Energy (MoE)

Alfred Phiri–Zambia Revenue Authority (ZRA)

Florence Simumba-Ministry of Water Development, Sanitation and Environmental Protection (MWDSEP)

Francis Mpampi- Ministry of National Development and Planning (MNDP) – i.e., National Designated Authority (NDA)

John L Chongo- Ministry of Higher Education (MoHE), Department of Science and Technology (DST)

Ben Makayi- Representative from Ministry of Higher Education,-i.e., National Designated Entity (NDE) Focal Point

Moses Ngosa -Representative from the Ministry of Commerce, Trade and Industry (MCTI)

Allen Polito-Energy Regulation Board (ERB)

Thomas Nyirenda -Zambia Electricity Supply Corporation (ZESCO Limited)

Chilufya Sampa-Competition and Consumer Protection Commission (CCPC)

Mete Banda -Transformco Power Services,-Zambia Association of Manufacturers (ZAM)

Sylvester Hibajene -Zambia Chamber of Commerce and Industry (ZACCI)

Eng Christopher Phiri-Engineering Institute of Zambia

Kasuba Kasengele-Zambia Compulsory Standards

C Kasase-National Designated entity (NDE), Ministry of education

Innocent Mandona-National Technology Business Centre

Mwembela-Zambia Environmental Management Agency

Chikoma Mwansa -Zambia Bureau of Standards (ZABS)

Wilson-Northwestern Energy Corporation

Suzyo Silavwe-Rural Electrification Authority

J Mwanza-Elsewedy Electric Zambia

Andrew Kamanga-Northwestern Energy Corporation

Christopher Mwape-Copperbelt Energy Corporation (CEC)

Mwansa Boderick-Copperbelt Energy Corporation (CEC)

7.4 ANNEX D – Zambia’s Socioeconomic Situation

The Republic of Zambia is a large, landlocked country in Southern Africa region surrounded by 8 countries: Democratic Republic of Congo to the north; Tanzania to the north-east; Zambia to the east; Mozambique; Zimbabwe; Botswana; and Namibia to the south; and Angola to the west. Zambia occupies an area of 752,618 square kilometres.³¹ In 2021, the current population is estimated at 18,920,657 and an average annual/intercensal growth rate of 2.9% for the period between 2000 and 2021.³² The average household size is 5.1 persons at national level. The total number of households estimated at national level were 3,014,965. The population was mainly concentrated in rural areas at 58.2% compared to 41.8% in urban areas³³

In 2020, Zambia recorded a per capita Gross National Income (GNI) of US\$1160.³⁴ In 2021 Gross Domestic Product (GDP) was 21.2 billion.³⁵ Zambia’s economy is heavily dependent on copper mining sector, considering that copper mining is the most important activity and accounts for around 85% of country’s exports. The national economic performances are strongly related with the price of copper. In 2019, COVID-19 has exacerbated Zambia’s macroeconomic vulnerabilities, the economic growth declined significantly, from 4% in 2018 to 1.4%.³⁶ The supply chain breakdown in major trading partners such as China and South Africa which has been affected by the COVID-19 Pandemic is negatively affecting domestic production and consumption.

The national peak demand for 2019 stood at around 2,925 MW although the installed capacity of about 2,900 MW, following the partial coming on stream of the Kafue Gorge Lower (KGL) which adds to the current installed capacity about 750 MW.³⁷ Zambia’s electricity demand is expected to double in 2030 due to an increased population.

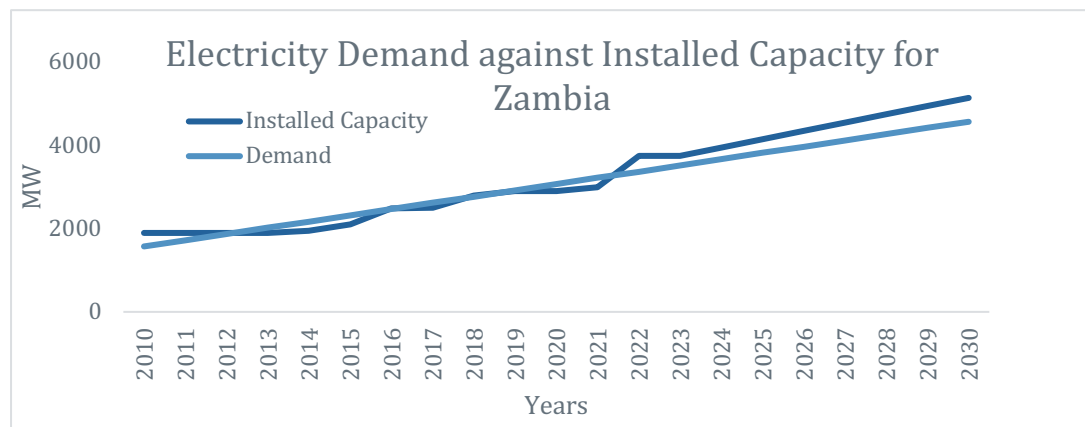


Figure 7-1: Electricity Demand against Installed Capacity for Zambia (Source; Zesco)

³¹ <https://www.nationsonline.org/one-world/zambia.htm>

³² The World Bank, 2020. The Country Profile.

<https://data.worldbank.org/country/ZM>

³³ Zambia-2015 Living Conditions Monitoring Survey, Central Statistical Office, Republic of Zambia, 2015. <https://prais.unccd.int/sites/default/files/2018-08/LCMS%202015%20Summary%20Report.pdf>

³⁴ The World Bank, 2020. The Country Profile. <https://data.worldbank.org/country/ZM>

³⁵ The World Bank data, GDP growth, 2021.

<https://data.worldbank.org/indicator/NY.GNP.PCAP.CD?locations=ZM>

³⁶ Market Assessment Report on Residential Refrigerators and Distribution Transformers, Green Climate Fund RZEMAINESS Project, 2021.

³⁷ ERB, 2019. Energy Sector Report, Lusaka: ERB

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 UNEP-U4E Model Regulation Guidelines, SANS941:2020, Ecodesign, US-DOE 10 CFR 430.32(a), and others. For DTs, example MEPS include the UNEP-U4E Model Regulation Guidelines, 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 do not 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 SADC/EAC harmonised MEPS that are developed using the global U4E tool) 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 and distributors 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 is followed by a verification where the potential offence is revealed through testing or validation of the products' performance claims. Finally, the enforcement step is the last where the authority takes action against the non-compliance offence. These actions should be commensurate with an offence in order to prevent any future offences 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). 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 or National Development Bank (NDB), the power utilities (the Electrical Supply Cooperation Zambia (ZESCO)) or the employer institutions, as well as EE technology providers;
- Address market barriers, align with the specific country context, and leverage local opportunities to maximise 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 – Financing Mechanisms for Refrigerators

7.6.1 On-bill Financing

The model:

On-bill financing is an innovative approach to financing energy efficiency that has proven to be effective for smaller investments and in increasing uptake of energy-efficient equipment. 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.

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.

Supporting mechanisms:

On-bill financing can be supported by capitalising 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 mostly on the interest and engagement of the utility, which in many cases is in part or in whole, government owned. The government can support the model by capitalising new on-bill loan funds, 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.

On-bill financing recommendations:

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

Zambia'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 (i.e., banking institutions such as National Bank of Zambia (NMB), FDH Bank, First Capital Bank of Zambia and Standard Bank or MFIs) 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 MDBs. 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 of Zambia (e.g., Ministry of Energy, etc.) or any non-commercial institutions (Zambia Energy Regulatory Authority) 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 electricity distributors or utilities (e.g., Local Authorities and Regional Councils, Electrical Supply

Cooperation Zambia (ZESCO)). 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, GCF, else), refined based on inputs from local experts in Zambia, 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 of 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 7-2: 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 of Zambia, households, the utility, partner local financial institutions, and partner technology providers with potential support from GCF, CTCN, 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. More than 84% of surveyed households were on a prepayment metering system, compared to less than 16% on post payment metering systems in Zambia in 2021. 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 power utility (ZESCO) 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 Zambia. 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 (ZESCO). Among other things, the utility adapts its information management system and prepaid metering system. In return, ZESCO 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, ZESCO 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 ZESCO and it does not bear the default risk. ZESCO 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. ZESCO 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. ZESCO 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 ZESCO 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 the confidentiality and data privacy policies in Zambia, it might be recommended that ZESCO leverages directly 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 ZESCO and partner local financial institutions. ZESCO'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 ZESCO, 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.

Semi-automated credit recovery processes between ZESCO and partner banks. With semi-integrated systems, 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 ZESCO needs to recover on an agreed frequency. This can also potentially be done by logging into ZESCO system and uploading the file with the list on the utility server. After getting approved credit customers into the utility system, the credit recovery is then automatic. Precisely, once contacted by a partner banking institution, ZESCO 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.

Bill repayments and credit recovery. When it comes to the customer's bill repayments and credit recovery on behalf of the partner bank, ZESCO shall confirm bill repayment transactions and credit recovery to partner banks are feasible and can be accommodated. ZESCO 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 ZESCO 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. 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 (MoE).** The support from the Government of Zambia is essential for the success of the on-bill financing mechanism option in Zambia. 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.
- **ZESCO.** The partner power utility plays a central role in on-bill financing by collecting credit repayments from customers in their respective regions. ZESCO must adapt, set up, manage, and maintain the credit recovery mechanism. By supporting the programme, ZESCO 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 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 ZESCO 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 ZESCO 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 ANNEX G – Recommended Detailed implementation Plan 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 include the following key action items:

Lead compliance entity (e.g., MoE)

- Source and engage interested local financial institutions and ZESCO 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 ZESCO (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 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 ZESCO (partner utility) 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, ZESCO, etc.)
- Review draft standardized agreement between partner providers and partner local financial institutions and ZESCO 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, ZESCO, MDBs, GCF, CTCN to support the operationalisation of the mechanism option in 2022
- 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., ZESCO, 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 ZESCO 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 ZESCO'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 ZESCO
- 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, ZESCO 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 ZESCO – the entities responsible of the loan repayment collection. This agreement aims to include the application process, requirements, eligibility criteria for salaried employees or ZESCO'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

7.8 ANNEX H– Distribution Transformers Supply Chain & Market Landscape in Zambia

The supply of distribution transformers in Zambia mainly depends on the transformer's buyer. The main buyers of distribution transformers in Zambia include ZESCO, Copperbelt Energy Corporation, and Mining Firms. The supply market for distribution transformers (DT) comprised both locally manufactured and supplier/imported transformers products, government officials, and other stakeholders, as shown in the DT supply chain in Figure 7-3. There are five key suppliers/manufacturers in Zambia: Elsewedy Transformers, AFRIZAM Electrical Limited, Tanelec Zambia Limited, Marthinusen and Coutts, and Eugene Lottering.

The power network in Zambia is owned and operated by ZESCO, the national power utility company. ZESCO is responsible for the operations and maintenance of transformers on the network. Zambia has an estimated total of 400 substations in the transmission system countrywide, with each substation, on average, having 1 or 2 power transformers with step-down capacities of 330/132kV or 132/33kV or 33/11kV, while in the distribution system, there are close to 19,400 distribution transformers with a step-down capacity of 33/0.4kV and 11/0.4kV.

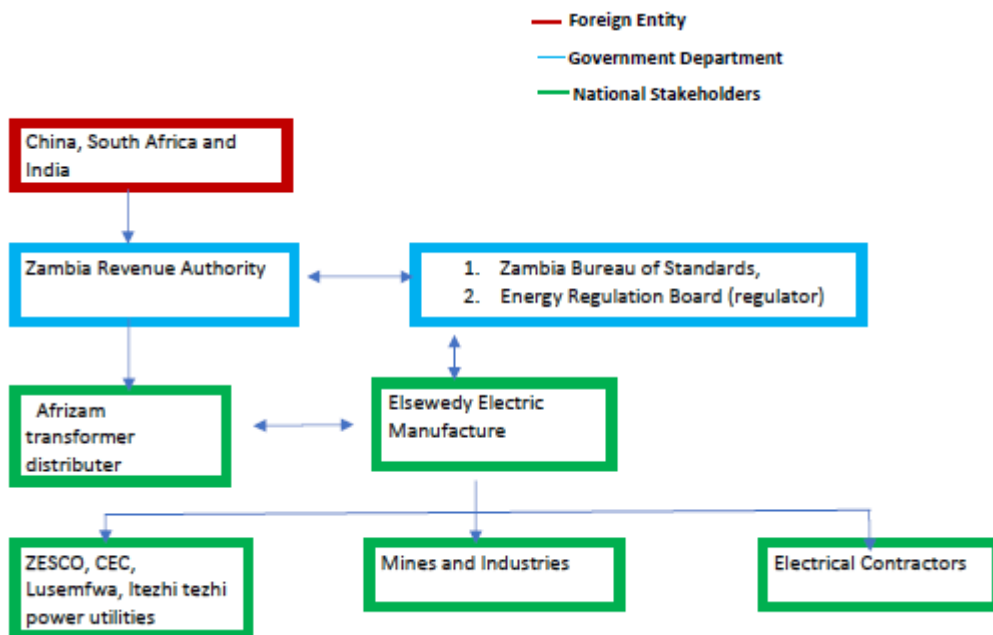


Figure 7-3: Flow diagram of Movement of Transformers in Zambia

- ZESCO owns and operates over 90% of the generation, transmission, and distribution assets in the country and supplies electricity to all grid-connected consumers in all the 10 Provinces of Zambia, with transmission and distribution lines of 9,975 km.
- Copperbelt Energy Corporation (CEC) network consists of 246 km of 220 kV lines (7.5% of Zambia's high voltage [HV] network), 678 km of 66 kV lines, and 41 substations. CEC's network assets in Zambia include 36% of the 142 km 220 kV line that connects the grid in Zambia to the DRC border.
- Elsewedy Electric is an Egyptian company based in Ndola, its positioned as a local manufacturer of distribution transformer ranging Up to 250 MVA and up to 220



kV.Elsewedy Electric coming on the market in collaboration with ZESCO to manufacture distribution transformers, and in some cases repairing transformers for ZESCO.

- AFRIZAM electrical limited in partnership with Rongzhong of China who are currently supplying the Zambian market with Electrical Equipment such as Sub Stations, Switch Cabinets, Switch Gear, Transformers and Fuses, etc.
- Tanelec Zambia Limited has been in operations in the Zambian mining services industry for offering servicing and repair of distribution transformers.

Foreign entities mainly from China, South Africa and India export transformers to Zambia which are subjected to excise duty and VAT regulations by the Zambia Revenue Authority (ZRA) while the Zambia Bureau of Standards and Energy Regulation Board (ERB) ensure conformity to technical specifications.

7.9 ANNEX I– Recommended Detailed Implementation Plan 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 (ESCO EPC mechanism - shared or guaranteed savings and/or Bulk Procurement mechanism). 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., MoFNP, 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 officialize 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.

7.10 ANNEX J– 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

Figure 7-4 highlights the fundamental aspects of MV&E.

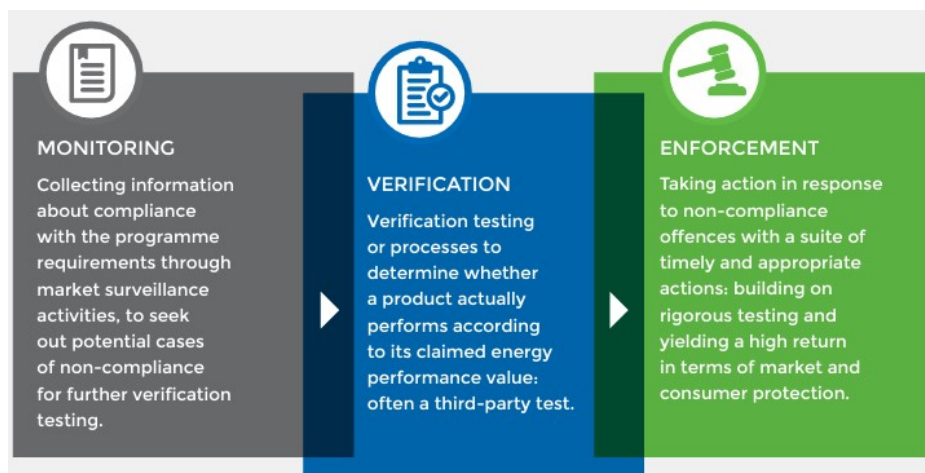


Figure 7-4: MV&E Process

Source: U4E (2017). Accelerating the Global Adoption of Climate-friendly and Energy-Efficient Refrigerators³⁸

The benefit of a proper MV&E program is to ensure compliance as summarized in Figure 7-5.

³⁸ <http://united4efficiency.org/wp-content/uploads/2017/06/U4E-RefrigerationGuide-201705-Final-R1.pdf>



Figure 7-5: Benefits of Proper MV&E Program for Energy-Efficient Appliance and Equipment Regulation

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

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 7-1: 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 7-6 depicts the overall framework for planning and reviewing the MV&E regime for appliance standards and labelling.

Planning and Reviewing a MV&E regime

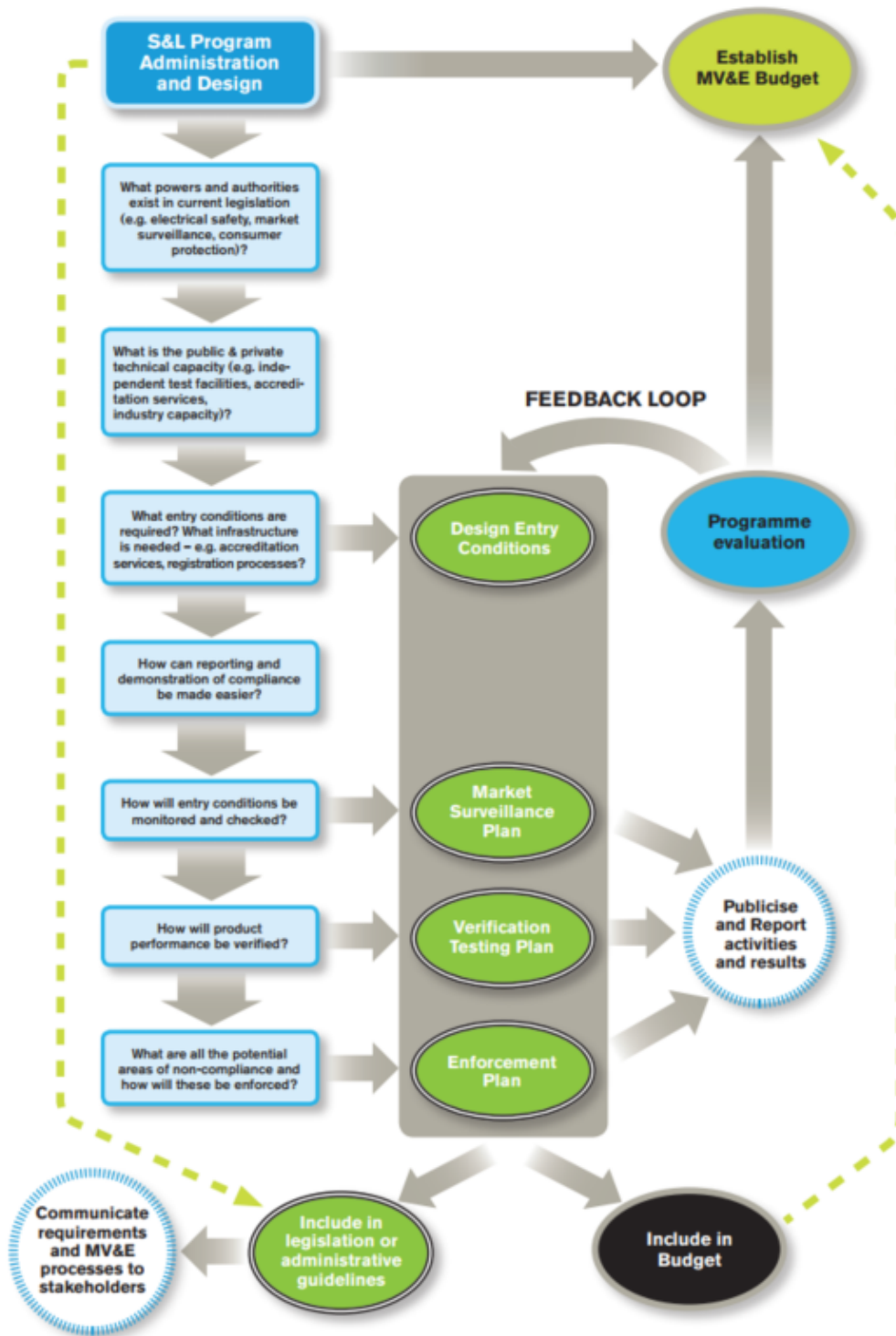


Figure 7-6: Planning and reviewing an MV&E regime

Source: Compliance Counts: A Practitioner’s Guidebook on Best Practice Monitoring, Verification, and Enforcement for Appliance Standards & Labelling, CLASP³⁹

³⁹ <https://clasp.ngo/publications/compliance-counts-a-practitioners-guidebook-on-best-practice-monitoring-verification-and-enforcement-for-appliance-standards-labeling>

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



Figure 7-7: 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 regulations⁴⁰.

- **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 practices⁴¹.

- **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.

⁴⁰ <https://united4efficiency.org/resources/ensuring-compliance-with-meps-and-energy-labels/>

⁴¹ 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 7-8 **Error! Reference source not found.**).



Figure 7-8: Pyramid of Escalating Enforcement

Source: UN Environment (2017)⁴²

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

⁴² U4E Policy Guide Series: Accelerating the Global Adoption of Climate-Friendly and Energy-Efficient Refrigerators, UN Environment, 2017

- Importers need 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)⁴³.

⁴³ 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)

7.11 ANNEX K– 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 Report⁴⁴

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-

⁴⁴ <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 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 7-9 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 7-9: Major Target Audiences for a Communication Campaign

Source: UN Environment (2017)⁴⁵

Table 7-2 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 7-2: Communication campaign stakeholders and areas of interest and involvement

| TARGET AUDIENCE | PRIMARY INTEREST | AREAS OF INVOLVEMENT |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| INSTITUTIONS/ GOVERNMENTS <ul style="list-style-type: none"> • Governments (potentially several ministries) • Electric utilities • Standards organisations • Customs authorities • Testing labs • Trade unions • Lobbying organisations – environmental advocacy; industry association | <ul style="list-style-type: none"> • 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. | <ul style="list-style-type: none"> • 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. |

⁴⁵ U4E Policy Guide Series: Accelerating the Global Adoption of Climate-Friendly and Energy-Efficient Refrigerators, UN Environment, 2017

| | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>BUSINESS</p> <ul style="list-style-type: none"> • Manufacturers • Industry associations • Wholesalers and retailers • Specifiers • Building owners and managers • Recyclers | <ul style="list-style-type: none"> • Promoting innovative, energy-efficient new technologies • Business prospects • Corporate responsibility • Reducing electrical consumption • Managing the end-of-life of refrigerators. | <ul style="list-style-type: none"> • 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. |
| <p>END USERS</p> <ul style="list-style-type: none"> • Customers • Civil society • Consumer and community associations • Environmental organisations | <ul style="list-style-type: none"> • Acquire information to make informed decisions about the savings associated with a switch to efficient refrigerators • Own energy-efficient products. | <ul style="list-style-type: none"> • 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. |
| <p>MEDIA AND OTHERS</p> <ul style="list-style-type: none"> • Media • Research and training institutes • Universities | <ul style="list-style-type: none"> • Increase awareness and develop knowledge about energy-efficient refrigerators among professionals and consumers. | <ul style="list-style-type: none"> • 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)⁴⁶

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

⁴⁶ 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

Zambia 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 Zambia, and with the aspirational goal of increased electrification, information access is important. As such, the Zambian 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; ZESCO 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. For other customers, it is important to consider including MEPS in public procurement for DTs