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IMPLEMENTATION STRATEGY - EFFICIENCY STANDARDS AND LABELING PROGRAMS IN UGANDA

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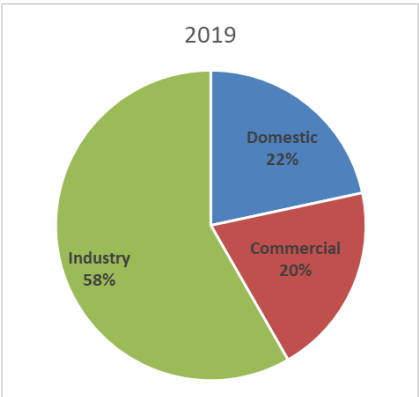
1. Introduction

In 2016, the development of an Energy Efficiency Roadmap (USAID, 2017) undertaken by Agency for International Development (USAID) showed that an energy-saving potential of 310 MW by 2030 was possible at a cost lower than the current supply of electricity. However, the energy-efficiency potential is spread out across many technologies and requires the establishment of enabling policies to stimulate efficient use of energy. Chief among these is the establishment of energy- efficiency standards and labeling (EESL) for electric equipment as indicated by Uganda national energy policy legislation (MEMD, 2002). This report first includes an assessment of energy consumption in the residential sector to identify priority products of focus for the EESL program followed by an assessment of the legal and administrative capacity needs of Ugandan institutions to operate and enforce Uganda’s EESL program.

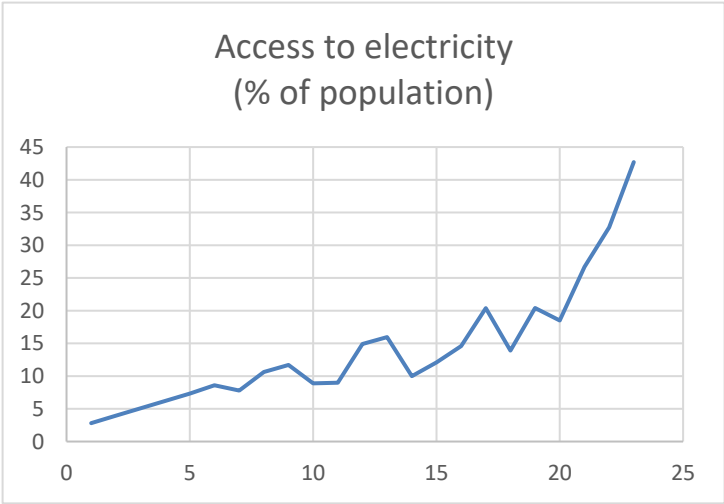
2. Prioritization

In 2019, grid electricity consumption in Uganda was 3,227 GWh. Of the total 1,268.9-MW installed capacity, 80% was hydro based, 8% cogeneration, 8% thermal, and 5% solar. Fifty-eight percent of electricity consumption occurred in the industry sector in 2019; 22% in the household sector, and 20% in the commercial sector (see Figure 1).

Figure 1 – Electricity Consumption per Sector **Figure 2 – Access to electricity (% of population)**



Source: (ERA, 2021)



Source: (World Bank, 2021)

Note: The electricity consumption per sector is based on a reallocation of each tariff class, see Annex 1

Access to electricity is growing rapidly in Uganda as can be seen in Figure 2. The share of population with access to grid electricity tripled in less than 5 years to reach 26.7% in 2018.

Additionally, off-grid access through sources like generators, rechargeable batteries, and solar devices (mostly solar lighting systems / solar lanterns) represents another 27% of Ugandan households (UBOS, 2018). Therefore, 51% of households have access to at least one source of electricity.

While ownership of radios/CD players/sound systems and regular mobile phone chargers have a similar ownership ratio for grid and off-grid users, the ownership of other equipment varies significantly as can be seen in Table 1 and Figure 3. It is interesting to note that off-grid users are particularly sensitive to energy efficiency as is demonstrated by the higher penetration of LED (67%) in off-grid households compared to grid-connected households (only 36%). This is due to the direct connection of solar photovoltaics (PV) capacity requirement and energy consumption.

Table 1- Distribution of Households Owning selected Electric Appliances (%) **Figure 3- Domestic Electricity Consumption breakdown per End-use**

	Grid Users	Off-Grid Users
Radio/Sound System	67.2	58.9
Regular phone charger	64.5	59.7
Lantern	31.5	28.3
LED Light Bulb	36	67
Smartphone charger	52.3	10.1
Electric Iron	61.9	0.9
Regular Color TV	53.4	6.6
Incandescent Bulb	28.9	12.5
CFL	34.4	3.8
Flat color TV	22.4	5.6
Refrigerator	24.6	0.6
Fan	11.3	0.3
Computer	10.2	1.1
Fluorescent Tube	5.4	3.7

Source: (MEMD, 2020)

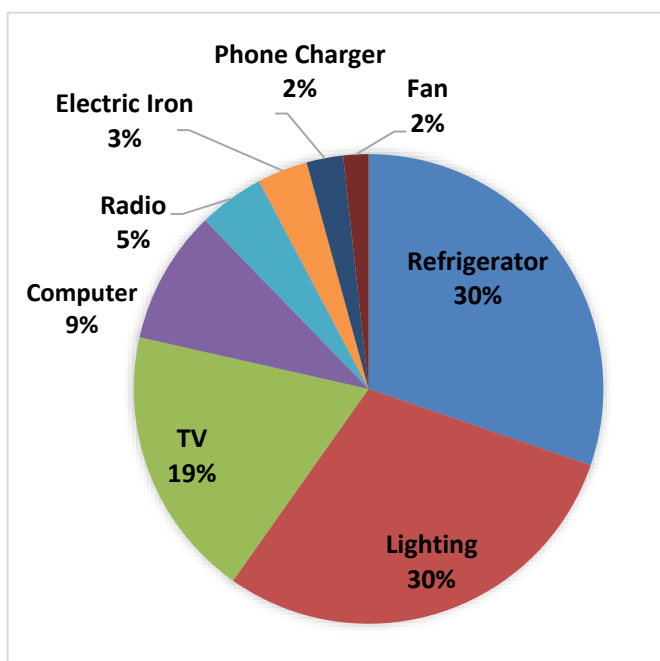
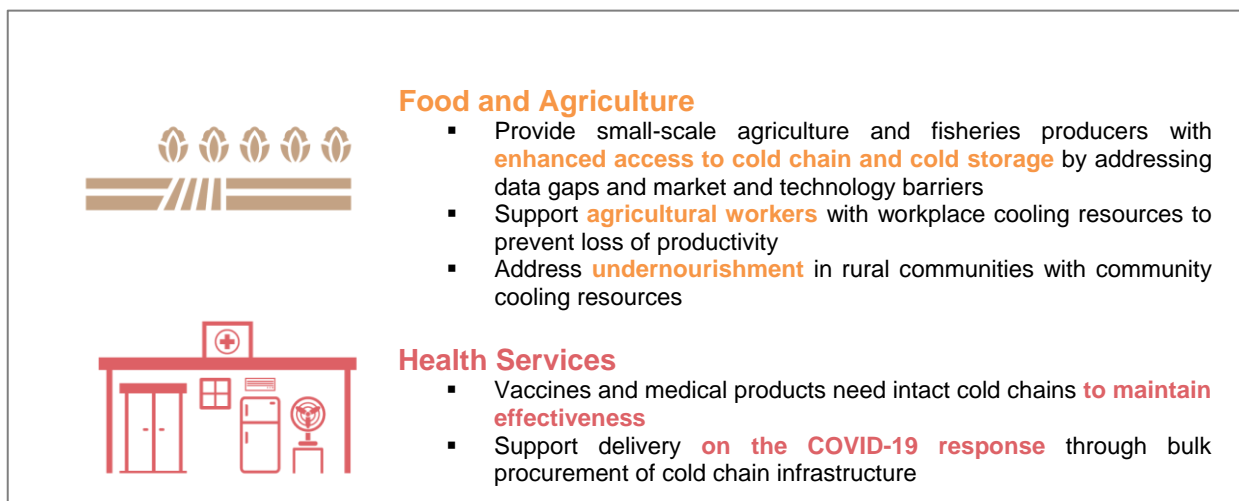


Figure 3 shows the estimated energy consumption per end use for the residential sector based on a survey published in 2020 (MEMD, 2020). The complete details assumptions used in the bottom-up calculation are available in Annex.

Refrigerators appear as the largest source of energy consumption with about 200 GWh/year, which represents a little less than a third of the electricity consumption in the residential sector. Incandescent light bulbs come next as a source of energy consumption followed by regular TVs and computers.

These end uses have energy-saving potential. For lighting, LEDs can replace incandescent bulbs and reduce energy consumption by a factor of 10. Also, existing opportunities for refrigerator energy efficiency can reduce energy use significantly. As highlighted in a United Nations Environment Programme (UNEP) report on refrigeration (UNEP, 2017), energy-efficient refrigerators hold the potential for saving as much as 60% of current use in developing countries with unregulated markets dominated by old technology refrigerators. Improved energy efficiency of refrigeration also contributes to achieve United Nations sustainable development goals that have been adopted by Uganda. The United Nations' organization, Sustainable for All (SEforAll) estimates that access to cooling is a sustainable development factor associated with two main themes: food, agriculture, and health services, as illustrated in Figure 4.

Figure 4. Opportunities to Address Access to Cooling Needs in Uganda



Considering these benefits and the opportunity for savings, the EESL should first focus on refrigeration products, followed by the replacement of older lighting technologies (incandescent bulbs).

3. Capacity Need Assessment

This section provides an overview of the different elements that constitute an effective EESL program. It describes the responsibilities for appropriate institutions as well as the tasks that must be carried out to operate the program effectively. It then evaluates the situation in Uganda, identifies areas that need strengthening and recommend tasks that must be carried out to build the necessary capacity in all key institutions. The review determines the existence of any major practical constraints that might limit program development and give an early indication of the program's viability, taking into account the likely resources and extent of political support.

3.1 Legal Framework

Legislation forms the basis of an effective mandatory EESL program. It is therefore essential to establish a strong, clear political legitimacy for mandating an authority agency to implement an EESL program. A framework legislation creates the legal basis and authority for developing labels and standards. The legislation should be generic and comprehensive, without specifying technical details related to specific products. It should designate a government agency as the “implementing agency” and give this agency the authority to issue product-specific minimum energy performance standard (MEPS). Framework legislation should also identify the main stakeholders and define their roles, responsibilities, and obligations.

3.1.1 Current situation in Uganda

Ministry of Energy and Mineral Development (MEMD) and the Uganda National Bureau of Standards (UNBS) developed and issued five MEPS in 2012 (lighting, refrigerators, freezers, motors, and air conditioners). However, these MEPS never gained legal enforcement authority. Two legal documents have been drafted since and are awaiting cabinet approval:

- The **Energy Efficiency and Conservation bill (EECB)** was drafted in 2014 and endorsed by the MEMD but still awaits Cabinet and Parliament financial year’s budget approval. The bill and associated regulations provide the legal basis required for elaborating and enforcing national policy targeting the efficient use of energy, including EESL regulations. The bill mandates MEMD to regulate energy efficiency and to put in place energy-efficiency standards in collaboration with UNBS and other stakeholders. UNBS will assist MEMD in issuing standards and in ensuring compliance to the regulations.
- MEMD has recently drafted a revised version of the 2002 **National Energy Policy** (MEMD, 2002) to guide the country’s energy sector policy development over the next 10 to 15 years. In this document, the government sets a goal to improve energy efficiency by a minimum of 20% by 2030 and identifies setting MEPS as the first of the list strategies to achieve this goal. The national energy policy document states: **“Government shall put in place an enabling framework to promote energy efficiency across all sectors of the economy.”**

3.1.2 Needs

The legal framework governing the efficient use of energy is still awaiting approval. Without this framework, there is a high risk that EESL will have very limited impact on the market, with limited enforcement capacity. Similar to neighboring countries such as Kenya and Rwanda, described in Section 3, the government of Uganda needs to pass the EECB and allocate the budget for its

application. Without strong political support, opportunities for substantial energy savings and carbon emissions reductions could be missed.

3.2 Administrative Capacity

3.2.1 Administrative Agency

The development and implementation of EESL requires institutional capacity and financial resources to operate the program. Dedicated staff will need to develop expertise in standards-setting and labeling programs and manage consultants to conduct technical analysis and assist in program management, including program oversight and coordination (see Box 1-Administrative Agency).

Financial resources are needed to support personnel, technical and market analysis studies and facilities to allow administering and enforcing the program. These may already exist to some extent but are likely to need to be bolstered to facilitate an effective S&L program implementation.

In some case, a regular and consistent source of funding for an operational budget can complement the government budget. This can be from the fees collected from manufacturers for registering their products and/or for the label. A country should assure itself that it has adequate resources, including an ongoing budget for operation and maintenance and for establishing or supporting the facilities.

Current situation in Uganda

MEMD has a dedicated unit for managing and implementing energy efficiency. This unit is the natural place for developing and managing the EESL program. MEMD will also work with UNBS to issue standards and ensure compliance. MEMD and UNBS needs to assess if additional budget is required to ramp up implementation of the EESL program.

Box 1- Administrative Agency Tasks

CAPACITY NEEDED TO:	Develop studies to inform decision making (e.g.: cost benefits analysis)
	Convene stakeholder engagements to inform, get inputs and persuade
	Draft new detailed regulations
	Develop public awareness campaigns
	Develop certification database and establish certification process
	Train personnel in certification, monitoring and enforcement
Monitor compliance and enforce the regulations	

Needs

A dedicated annual resource allocation should be drafted that assigns and schedules available resources to specific tasks that need to be completed for the implementation and operation of the EESL program. This resource allocation plan should be allocated every year to allow the program to succeed and grow. Additionally, a study tour in neighboring countries with successful program implementation could help design and estimate the cost and time needed for developing the resource allocation plan.

3.2.2 Standards Organization

Most countries in the world have national standardization organizations that develop and publish technical standards to specify product requirements to be sold on a market. They also develop or adopt test procedures that verify the performance of the products. Standards are generally defined for the purpose of safety or for consumer protection from deceitful practices. For energy requirements, the IEC (International Electrotechnical Committee), or ISO (International Organisation for Standardisation) have published specified procedure for test methods that are internationally recognized and adopted.

Test procedures should:

- Reflect typical usage
- Yield repeatable and accurate results
- Be relatively inexpensive to perform
- Be developed domestically or adopted from an international body.

Current Situation in Uganda

UNBS was established in 1989 under the Ministry of Trade, Industry, and Co-operatives. UNBS's mandate is to formulate, promote, and enforce standards. UNBS issued five MEPS in 2012 for lighting, refrigerators, freezers, motors, and air conditioners. No regulation exists to enforce these MEPS, so they have not been implemented. MEMD and UNBS have also developed a guide to assist importers and the business community dealing with the five appliances to understand the MEPS. The guide contains parameters related to energy consumption, to which imported appliances must conform.

Needs

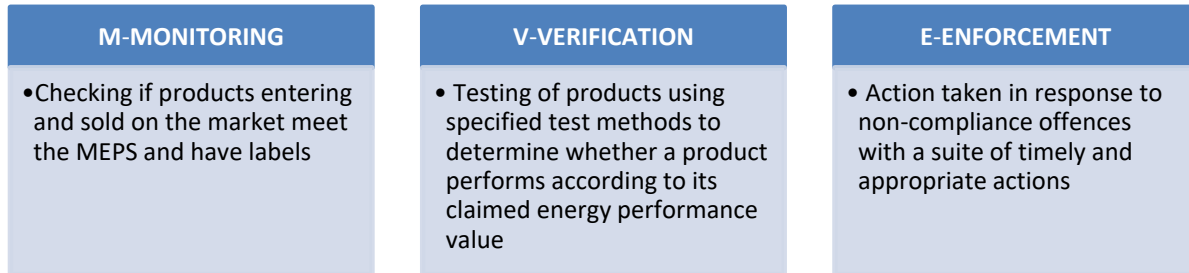
UNBS needs to work with the regulatory authority, MEMD, to assess if the standards procedures need to be updated or if new procedures are needed to conform to the regional harmonization efforts under the Energy-Efficient Lighting and Appliances program (EELA) (see Section **Error! Reference source not found.**). UNBS needs to estimate their capacity needs and if training is needed to understand test procedure applications.

3.3 Monitoring, verification and enforcement (MV&E)

The success of EESL depends on rigorous and strategically focused methods that ensure compliances. Monitoring, verification and enforcement are all actions that ensure that products meet MEPS and therefore that energy savings are delivered.

The different components include:

Figure 5. Monitoring, verification and enforcement (MV&E)



3.3.1 Monitoring

Compliance monitoring generally occurs at two different market point:

Entry Condition: this consists in requiring a test or certification report by product suppliers at the point of entry in order to establish responsibility for the claimed performance of an individual model.

Market surveillance: this consists in checking whether products conform to registered claims from suppliers once the products are in the market place.

Test reports that suppliers need to surrender can be issued by either an accredited third-party laboratory or an in-house test laboratory. In either case, testing needs to comply with standardized methods are defined in the MEPS regulation and set by the Standardization Organization such as UNBS.

Monitoring is generally supported by a registration process that compiles information on new products entering the market and register product information, including claimed energy performance and test reports, see box on product registration (Box 2)

Box 2 – Objectives of Certification Registration Databases

Certification Registration Databases:

- ▶ Provide authoritative information about the energy performance and other characteristics of the products available on markets
- ▶ Incentivize manufacturer to comply with the law
- ▶ Provide up-to-date information to distribution supply chain and consumers about products that qualify and other product features.
- ▶ Allow policy makers to better track market trends

Example: Kenya Registers of Electric Appliances (EPRA, 2021)

In countries (e.g., European Union, United States, Australia) where both third-party certification and self-authorization are admitted, MV&E strategy are reinforced with market surveillance, verification and severe penalties such as fines or bans.

Current situation in Uganda:

Uganda adopted the pre-export verification of conformity (PVoC), an international inspection and verification program that checks compliance against technical regulations and standards. This inspection scheme has been also adopted by neighboring countries Kenya, Rwanda, and Tanzania. To minimize delays and reduce time spent to clear consignments, UNBS introduced a web-based system, E-Portal for inspection and clearance of goods.

Needs

Products covered by MEPS need to be included in the list of products that are subject to PVoC and then be accompanied by a certificate of conformity (COC) approved by a UNBS-appointed pre-shipment inspection agent in the country of origin. The PVoC inspection process needs to include the requirement of the MEPS and label.

In addition to the PVoC process, Uganda needs to require that suppliers register their products prior to putting them on the market, allowing for a registration database that can be used to check compliance of incoming products. Kenya has already developed such a database for its local market, which is run by the Energy and Petroleum Regulatory Authority (EPRA). The EELA program is planning to develop a regional product registration system (PRS). MEMD and UNBS need to assess Uganda's process for making use of the PRS.

MEMD and UNBS need to work together to establish a compliance plan that defines the role of each institution; the process for checking compliance at the market entry point and once products are in the market; the needs for staff time; and the need for guideline documents and customs inspector training.

3.3.2 Verification

Verification is the process of checking whether a product actually performs according to its claimed energy performance rating. This process entails verification through testing, which will require the capacity of testing laboratories.

Lack of testing laboratories is, therefore, a barrier to MV&E. Testing facilities can be either government establishments or independent commercial enterprises. They generally require a suitably equipped facility and a high level of skill to operate it (CLASP, 2010). Establishing a new national test facility should only be considered if there is a business case for it. CLASP developed a tool to assess the business case for establishing a testing laboratory (CLASP, 2021). In some instances, facilities are located at universities to facilitate training. An option for countries with limited budgets is to pool resources with neighboring countries to establish a regionally funded

and managed test laboratory. Another option is to rely on existing accredited government-owned or privately owned test labs located outside of the country, setting up Mutual Recognition Agreements (NAEWG, 2021). In this case, estimation of the costs and potential issues for sending the product should be carefully assessed.

Current Situation in Uganda

Testing capacity is only available for lighting in Uganda. Under the EELA program, the East African Centre of Excellence for Renewable Energy and Efficiency (EACREEE) will assess the possibility of building a regional Test Center of Excellence to increase capacity-building activities such as training of national laboratory technicians and sharing best practices. The Regional Test Centers would also help coordinate testing outsourcing by maintaining contacts and information of the existing accredited laboratories in the regions.

Needs

Local testing capacity should be assessed for each equipment type covered by the EESL program. Different options should be assessed to estimate the best options for testing when needed for verification.

The Global Appliance Testing Costs Catalogue was developed by SEAD (Super-Efficient Equipment and Appliance Deployment Initiative), CLASP, and P&R Energy to estimate the capital and operational costs of setting up and running test facilities for refrigerators. (SEAD, 2019). Figure 5 shows the cost of testing equipment required for establishing such test facilities. For example, the cost of testing domestic refrigerators in the Middle East and North Africa ranges between \$480-\$2,939 as per the ISO 15502:2005; EC 643/2009; SASO 2892:2018; IEC 62552; and ISO 7371.

Figure 6: Domestic refrigerator - Lab capital and operational cost

Expense Category	Low Estimate (USD)	High Estimate (USD)	Description
Capital Costs			
Product-specific equipment*	\$252,000	\$602,000	Test chamber, air handling system, chiller, control and measurement equipment, test loads and conditioning, software.
Generic equipment (usually pre-owned)	\$3,000	\$5,000	Voltage stabilizer, ambient temperature controls, meters and sensors.
Accreditation		\$5,000	To ISO 17025
Inter-laboratory trials		\$5,000	For calibrating proficiency
Operational Costs			
Staffing		2	Minimum number of trained technicians
Space		50m ²	Minimum space requirements
Equipment calibration and maintenance		\$2,000	Estimated annual cost
Capacity building, staff training, laboratory re-accreditation and re-certification		\$2,000	Estimated annual cost

Source: (SEAD, 2019)

Factors such as presence of multiple compartments, noise testing etc. increase the cost of testing. Also, if international shipping is required for products to be tested, that can lead to additional costs.

3.3.3 Enforcement

Enforcement is defined by the actions taken in response to noncompliance to EESL. If the penalties for non-compliance offences are low, then there is less motivation to comply, harming the integrity of the program. EESL administrators need to consider the design and implementation of procedures for responding to non-compliance offences. These procedures or strategies may include a suite or hierarchy of planned, escalating responses, and provide multiple opportunities for the offender to admit or rectify the noncompliance. Clear penalties need to be defined and communicated to prevent non-compliance.

Ghana's ban on imports of used appliances is strictly enforced by the Energy Commission and the Customs Division of the Ghana Revenue Authority. For example, in November 2013, the United Kingdom recycling firm Environcom was found to have illegally imported 4,000 second-hand refrigerators to Ghana. The containers were impounded by the Revenue Authority and sent back to the United Kingdom.

Current Situation in Uganda

Enforcement of standards currently employs Ugandan standards to protect the health and safety of the public and the environment against dangerous and sub-standard products. If a product does not meet the critical minimum requirements for health and safety as per the Ugandan Standards, its entry is prohibited and it is seized for destruction or re-exportation at the importer's expense.

Needs

A short description of the current penalties for noncompliance for MEPS is needed. This should be communicated to suppliers.

4. Regional Programs

4.1 The Energy Efficient Lighting and Appliances Program

The Energy Efficient Lighting and Appliances program (EELA) is implemented by the United Nations Industrial Development Organization (UNIDO) and is executed with support from the EACREEE and the Southern African Development Community Centre for Renewable Energy and Energy Efficiency (SACREEE). It is funded by the Swedish International Development Corporation (SIDA) and Swedish Energy Agency (SEA) UNIDO, 2021. The main objective is the development of regionally harmonized MEPS for lighting and appliances for both SADC and EAC. The EELA program started in June 2019 and spans 5 years.

The program outcomes envisioned in the implementation phase are to:

- Establish a regional mechanism and platform to coordinate market transformation activities of energy-efficient lighting and appliances that will continue through the entire 5 years of the project.
- Improve the regional policy and regulatory environment for energy-efficient lighting and appliances in the SADC and EAC. This also includes development of MEPS in the first 3 years of the EELA project.
- A multi-year effort to improve testing capabilities, strengthen stakeholder groups, and support key institutions for EELA implementation. This also includes setting up regional and national registries of lighting products in 2023.
- Create awareness among market players and policy makers on energy-efficient lighting and appliances, which also includes developing a product database for EELA.
- Create market incentives to stimulate the uptake of energy-efficient lighting and appliances. The project will offer supply chain actors technical assistance and financial incentives to deliver efficient and high-quality energy services. Particular support will be provided to Energy Service Companies (ESCOs).

EELA is assisting EACREE to develop a Regional Compliance Framework (EACREE, 2020) to further support resource-strained national-level efforts to enforce policy compliance and ensure market protection, by facilitating regional collaboration, market intelligence sharing, documenting and exchanging best practice, and aligning compliance methodologies to protect the regional market as a whole.

4.2 Kenya EESL Program

Kenya first published MEPS for six products in 2013: small air conditioning (AC) units, refrigerators, three-phase cage induction motors, double-capped fluorescent lamps, ballasts for fluorescent lamps, and compact fluorescent lamps. Regulations to enforce MEPS for ACs and refrigerators were passed in 2016. MEPS on imported ACs were enforced in 2017, and for local manufacturers in 2018, before being revised in 2019, with modifications to adapt to local climate and to align with international standards. Refrigerator MEPS and labelling program were implemented in 2018 (CLASP, 2019; N. Wagura., 2019).

4.2.1 Legal Framework

The Energy Act of 2006 (Government of Kenya, 2006) provides the legal framework necessary to develop energy-efficiency programs including the standards and labelling program for equipment and appliances (UNDP, 2021.; CLASP. 2019). The 2006 Act also created the Energy Regulatory Commission (ERC), which was renamed EPRA in 2019. (Government of Kenya, 2019) EPRA mandates the formulation, implementation, and enforcement of energy-efficiency regulations.

In 2016, the Energy Appliances' Energy Performance and Labeling Regulations were passed, which mandate the 2013 MEPS for ACS that was developed in 2013. The regulation also includes principles to enforce the standards.

In 2019, the Energy Act of 2006 was repealed and replaced by the Energy Act of 2019 to take further steps towards the modernization and development of the energy sector. It requires the adoption of energy-efficiency and conservation measures and establishes EPRA as a successor to the ERC. The 2019 Act sets up the institutions and framework for the country's energy policy, empowering EPRA to coordinate the development and implementation of a national energy-efficiency and conservation program. It also endows EPRA to implement the EESL program (Government of Kenya, 2019).

In 2020, the National Energy Efficiency and Conservation Strategy (NEECS) was published to provide a road map in five identified priority sectors—households, buildings, industry and agriculture, transport, and power utilities—to realize the goal of sustainably transforming Kenya to an industrialized middle-income nation by the year 2030, as envisioned in Kenya Vision 2030 (Government of Kenya, 2020).

4.2.2 Administrative Capacity

EPRA is the central regulatory body for implementing energy efficiency. It also mandates enforcement and review of regulations.

Different agencies contribute with EPRA to the implementation of MEPS:

- The Kenya Bureau of Standards (KEBS) is the standardization organization in Kenya. It was established in 1974 to develop and promulgate technical standards. It is also responsible conformity assessment, training, and certification services.
- The Centre for Energy Efficiency and Conservation (CEEC) was established in 2006 through an association between the Ministry of Energy and the Kenya Association of Manufacturers. It provides capacity-building and creates awareness in energy-efficiency and conservation efforts.
- The Kenya Revenue Authority (KRA), established in 1995, works with the customs department to ensure that no substandard appliances are shipped into the country (UNDP, 2021).
- The Kenya Anti-Counterfeiting Agency was established as a state corporation currently under the Ministry of Industrialization, Trade and Enterprise Development in 2010 to inform the public about counterfeiting and enforcing energy performance compliance of imported products (International Institute for Energy Conservation, 2013).

4.2.3 Monitoring, Verification and Evaluation

EPRA oversees enforcement of efficiency standards and regulations. It requires importers of appliances covered under EESL regulations to register their appliances. The registration process includes submission of a test certificate and test report from an accredited laboratory confirming compliance to the Kenyan MEPS and payment of a registration fee. Based on these documents, EPRA issues a registration certificate and the appropriate energy label for the appliance, which is mandatory and must be fixed to all air conditioners sold in Kenya. It contains information about the manufacturer, model number, energy-efficiency ratio (EER), refrigerant, cooling capacity, annual energy consumption, and the applicable Kenyan standard. EPRA also maintains a public database of all appliances registered under the EESL program. (EPRA,2021)

KEBS and the Kenya Industrial Research and Development Institute (KIRDI) have performance testing facilities for lighting and motors (CLASP, 2019). KEBS also manages the PVoC program, which began in 2005 and is backed by Legal Notice No. 78 issued by the Ministry of Trade. They manage the PVoC implementers and perform market surveillance. A pre-shipment inspection (PSI) framework been created that will also include MEPS and labels for imported appliances (UNDP, 2021). EPRA can also conduct inspections on distributor warehouses to check for compliance. In case of non-compliance, EPRA asks for re-testing of the products. If the non-compliance is still not addressed, EPRA can levy a fine of KES 100,000 (CLASP, 2019).

4.3 Rwanda EESL Program

In May 2013, Rwanda Utilities Regulatory Authority (RURA) adopted guidelines promoting energy-efficiency measures stipulating that all appliances display energy labels and adhere to the MEPS (Ministry of Infrastructure, 2015). Voluntary MEPS for compact fluorescent lighting (CFL), motors and refrigerators were then developed. In 2019, mandatory MEPS for AC units and refrigerators were published under the National Cooling Strategy (NCS) initiative (Ministry of Environment, 2019).

4.3.1 Legal Framework

In 2015, the Rwanda Energy Policy was published to recommend ways to promote energy efficiency through regulations, new codes and standards, economic incentives, energy-efficiency audits, and barrier removal programs (Ministry of Environment, 2019).

In 2018, the country established the Energy Sector Strategic Plan to set energy-efficiency targets for 2023/2024 across generation, transmission, distribution, and end-user consumption (Ministry of Infrastructure, 2015).

In 2019, the government of Rwanda published the NCS under the Rwanda Cooling Initiative (R-COOL) to develop MEPS and bring stakeholders in the energy-efficiency sector to transform the

market for cooling products. The R-COOL program has been implemented by UNEP along with Ministry of Environment (MOE), Rwanda Environment Management Authority (REMA) and the Ministry of Infrastructure (MININFRA) and funded by the Kigali Cooling Efficiency Program (K-CEP) (UNEP, 2018)

MOE and MININFRA are the central ministries for developing energy policies and strategies, monitoring and evaluating projects, and for program implementation. They also oversee investment mobilization and promotion for the energy sector (Ministry of Infrastructure, 2018), (Ministry of Infrastructure, 2015).

Other bodies that support the implementation of MEPS are:

- REMA will coordinate the overall reporting for the NCS program.
- The Rwanda Standards Board (RSB) adopts international standards into national standards and relevant test procedures.
- The REMA, established under the Ministry of Environment, which coordinates implementation activities, monitoring, reporting—and conducts trainings on cooling equipment and how to identify energy-efficient equipment and refrigerants.

4.3.2 Monitoring, Verification and Evaluation

RSB conducts market assessments to show compliance of a product, service, or system to its standard, which includes testing, certification, and inspection. The equipment manufacturer is required to provide an energy label on the product that indicates the model name and number, country of manufacture, rated performance grade (A to E) and annual energy consumption (kWh). The label should be fixed in a location that is readily visible to the consumer (Ministry of Infrastructure, 2018), (Ministry of Infrastructure, 2015).

Under the NCS, REMA is developing a monitoring and evaluation framework to facilitate evidence-based reporting. The standards mandate that the evaluated efficiency in terms of cooling seasonal performance factor (CSPF) shall not be less than 95% of the published efficiency, and that all other tolerances of tests conducted shall meet the requirements as per the ISO 5151 and ISO 16358 standards. Random testing of appliances from the market is also conducted to check for compliance and published in the Conformity Assessment Report (CAR).

The CAR is required for any model to be sold in the market. RSB / RURA has been tasked with the development of a product registration system to support certification and testing to ensure compliance. Once the CAR is approved, the product will be listed in the product registration system, and the model can be sold in the market. If the test results are not correct and the CAR is rejected, a written explanation is provided to the submitter. Until the CAR is approved, the product cannot be sold in the market. RSB conducts enforcement by barring the sale of non-

compliant products in the country and verifying the CAR prior to making the product available for sale.

5. Conclusion

This report provides an assessment of the current energy consumption in Uganda's residential sector and identifies refrigeration products as the focus for the development of the EESL program. It also reviews the existing legal and administrative framework, and highlights the absence of a robust monitoring, verification, and evaluation plan in Uganda. Due to the lack of a legal framework, it is noted that the current standards are voluntary. Introduction of fines and mandates will help ensure higher compliance and enforcement of these standards. The standards and labelling programs in neighboring regions like EELA, Kenya, and Rwanda, have also been reviewed to understand what policies and frameworks can be used as reference to develop a successful standards and labelling program for domestic refrigerators in Uganda.

Based on review presented from EELA, Kenya, and Rwanda, a brief overview of categorization of roles and responsibilities between MEMD and UNBS is presented below.

Roles and responsibilities of MEMD

- MEMD will act as the central Ministry for developing energy policies and for program implementation and enforcement. They may also oversee investment in energy efficiency programs.
- It will coordinate the overall reporting for the energy efficiency program, which includes coordinating implementation activities, monitoring, reporting and personnel training on cooling equipment, and identification of energy-efficient equipment and refrigerants.
- MEMD in conjunction with UNBS can ensure compliance of products entering the market to Uganda's standards. It can conduct inspections of distributor warehouses to check for compliance.
- MEMD will ensure enforcement of efficiency standards and regulations. It can maintain central database of approved appliances and will require importers of appliances covered under S&L regulations to register their appliances. MEMD will be the nodal agency for issuing registration certificate and appropriate energy label without which the product cannot enter the market. Similar to Kenya, MEMD can also maintain a public database of all appliances registered under the S&L program.

Roles and responsibilities of UNBS

- UNBS can be established as the nodal organization, which will be responsible for development and dissemination of technical standards. It can also adopt international standards into national standards and relevant test procedures.
- It will be responsible for hosting the performance testing facilities for different appliances and certification services. It will conduct market assessment to show compliance of products to their relevant standard, which includes testing, certification and inspection.
- It can also oversee conformity assessment and training. Along with other import agencies, it can ensure conformity of imported products as per Uganda's EE S&L program.

6. References

- Collaborative Labeling and Standards Program (CLASP), Mark Ellis & Associates. (2010). "Compliance Counts: A Practitioner's Guidebook on Best Practice Monitoring, Verification, and Enforcement for Appliance Standards & Labeling," http://www.clasponline.org/~media/Files/SLDocuments/2006-2011/201009_MVEGuidebookSingle.pdf
- CLASP. (2019). Kenya Room Air Conditioner Market Assessment and Policy Options Analysis. Retrieved from CLASP: <https://www.clasp.ngo/research/all/kenya-rac-market-assessment-and-policy-options-analysis-2019/>
- CLASP. (2021). Guide to Building Sustainable Testing Capacity in ECOWAS. Retrieved from CLASP: <https://www.clasp.ngo/research/all/guide-to-building-sustainable-testing-capacity-in-ecowas/>
- EACREE. (2020). Regional Compliance Framework. Retrieved from The East African Centre of Excellence for Renewable Energy and Efficiency: <https://www.sacreer.org/article/eela-compliance-framework-east-and-southern-africa>
- Energy and Petroleum Regulatory Authority (EPRA), Government of Kenya. (2021). Kenya Registers of Electric Appliances. Retrieved from <https://www.epra.go.ke/services/energy-efficiency-project/registers-of-energy-efficiency-and-management-licensed-practitioners/>. Date Released 27 August 2020
- Electricity Regulatory Authority, Uganda. Date Released: 18 August 2018. Electricity supply industry performance report for the year 2019.
- Government of Kenya. (2006). The Energy Act, 2006. Date of Assent: 30 December 2006, Date of Commencement: 7 July 2007. An Act of Parliament to amend and consolidate the law relating

to energy, to provide for the establishment, powers and functions of the Energy Regulatory Commission and the Rural Electrification Authority, and for connected purposes. [L.N. 142/2007, Act No. 6 of 2009, Act No. 12 of 2012.]
http://kenyalaw.org/kl/fileadmin/pdfdownloads/Acts/EnergyAct_No12of2006.pdf

Government of Kenya. (2019). The Energy Act, 2019. No.1 of 2019. Kenya Gazette Supplement No. 29 (Acts No. 1), Republic of Kenya. Nairobi, 14 March 2019. Date of Assent: 12 March 2019. Date of Commencement: 28 March 2019. <https://www.epra.go.ke/download/the-energy-act-2019/>

International Institute for Energy Conservation. (2013). Capacity Building for Energy Standards and Labels. Date Accessed: August 2021. <https://www.iiec.org/training/182-kenya/539-capacity-building-for-energy-standards-and-labels>

MEMD. (2002). National Energy Policy. Retrieved from Uganda Ministry of Energy and Mineral Development:
https://www.energyandminerals.go.ug/site/assets/files/1081/draft_revised_energy_policy_-_11_10_2019-1_1.pdf

MEMD. (2020). National Electrification Report For Energy For Rural Transformation-ERT III Baseline Survey, 2018. Uganda Ministry of Energy and Mineral Development.

Ministry of Energy, Government of Kenya. (2020). Kenya National Energy Efficiency and Conservation Strategy.

Ministry of Environment, Republic of Rwanda. (2019). National Cooling Strategy.

Ministry of Infrastructure, Republic of Rwanda. 17 March 2015. Rwanda Energy Policy.

Ministry of Infrastructure, Republic of Rwanda. September 2018. Energy Sector Strategic Plan 2018/19 – 2023/24.

North American Energy Working Group. Date accessed: 31 December 2021. North American Energy Efficiency Standards and Labeling.
https://www1.eere.energy.gov/buildings/appliance_standards/pdfs/naewg_report.pdf

SADC, SACREEE, and EACREE. (2021). Review of the 'Energy efficient lighting and appliances project in Southern and Eastern Africa'. Date of Access: August 2021.

Super-Efficient Equipment and Appliance Deployment Initiative (SEAD). (2019). Global Appliance Testing Costs Catalogue.

United Nations Development Programme, Kenya. Date accessed: August 2021. Energy efficiency through standards and labels programme.
<https://www.ke.undp.org/content/kenya/en/home/ourwork/environmentandenergy/successories/energy-efficiency-through-standards-and-labels-program-.html>

United Nations Environment Programme. (2017). Report on Refrigeration. United Nations Environment Programme.

United Nations Environment Programme. 20 July 2018. Rwanda's New Cool Endeavour. Date Accessed: 17 November 2021. <https://www.unep.org/news-and-stories/story/rwandas-new-cool-endeavour>

USAID. (2017). Retrieved from Agency for International Development: https://www.usaid.gov/sites/default/files/documents/1860/Energy_Efficiency_Roadmap_for_Uganda_FINAL.pdf

Wagura N. 2019. "Policy measures to prevent dumping of environmentally harmful and low efficiency cooling appliances in African countries: Kenya as a case study." 10th International Conference on Energy Efficiency in Domestic Appliances and Lighting (EEDAL'19)

World Bank. (2021). World Bank Global Electrification Database from "Tracking SDG 7: The Energy Progress Report" led jointly by the custodian agencies: the International Energy Agency (IEA), the International Renewable Energy Agency (IRENA), the United Nations Statistics Division (UNSD), the World Bank and the World Health Organization (WHO). <https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS?locations=UG>

7. Annex

Annex 1. Electricity Sector Breakdown Adjustment Factors

ERA reports electricity consumption broken down by voltage level demands such as class as extra-large, large industrial, medium industrial and commercial tariff classes, rather than actual customer type classification. To estimate electricity consumption per sector, the customer list from UMEME from 2015 was used to determine how tariff classifications should be mapped to the customer type classifications assessed. Table 2 shows the breakdown of energy consumption into the two customer types for each of the applicable tariff classes

Table 2. Percentage of Consumption per Customer Type for Each Tariff Class

		Tariff Classes		
		Large Industrial	Medium Industrial	Commercial
Sectors	Industrial	86%	50%	27%
	Commercial	14%	50%	73%

Annex 2. Electricity consumption per End Use Assumption and Calculation

Appliances Owned	Grid Users			Off-Grid Users			Assumption	
	Ownership	hours/day	GWh	Ownership	hours/day	GWh	Watt	kWh/unit/yr
Radio/CD Players/sound system	67.2	6	29	58.9	6.5	28	9	19
Regular mobile phone charger	64.5	3.4	9	59.7	4	10	5	6
Torch/flashlight/ lantern	31.5	2.3	5	28.3	3.5	7	9	7
LED Light Bulb	36	9.3	17	67	9.6	33	6	20
Smartphone (internet phone) charger	52.3	3.6	8	10.1	4.5	2	5	6
Electric Iron	61.9	0.05	23	0.9	0.8	5	855	16
Regular Color TV	53.4	6.6	103	6.6	4.1	8	34	82
Incandescent Light Bulb	28.9	8.5	108	12.5	8.9	49	51	159
Compact Fluorescent Light (CFL) Bulb	34.4	9.1	50	3.8	12.4	8	19	62
Flat color TV	22.4	6.8	19	5.6	5.6	4	15	36
Refrigerator	24.6	8.6	197	0.6	3.7	2	109	400
Fan	11.3	2.1	11	0.3	3	0	56	43
Computer	10.2	5.2	107	1.1	3.5	8	235	446
Fluorescent Tube	5.4	8.1	12	3.7	7.6	8	31	92

Source: Ownership and hours of use from Uganda electricity Survey published in MEMD (2020)