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Mitigation Enabling Energy Transition in the MEDiterranean region

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NATIONAL MINIMUM ENERGY PERFORMANCE STANDARDS (MEPS) AND LABELING PROGRAM FOR APPLIANCES IN LIBYA

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RCREEE

Regional Center for Renewable Energy and Energy Efficiency

المركز الإقليمي للطاقة المتجددة وكفاءة الطاقة

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ABOUT THE PROJECT

The Mitigation Enabling Energy Transition in the Mediterranean region “meetMED” is an EU-funded project developed by the Mediterranean Association of the National Agencies for Energy Management (MEDENER) and the Regional Centre for Renewable Energy and Energy Efficiency (RCREEE).

With the objective of contributing to energy and climate transition Southern Mediterranean Neighbourhood through a multi-scale, multi-partner inclusive approach, meetMED II activities aim at developing a more stable, efficient, competitive, and climate-resilient socioeconomic environment in Southern Mediterranean countries, by fostering regional cooperation for Energy Efficiency measures and implementing demo actions.

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LIST OF ABBREVIATIONS

AC	Air Conditioner
Btu	British Thermal Unit
EE	Energy Efficiency
EER	Energy Efficiency Ratio
GECOL	General Electrical Company of Libya
GWh	Giga Watt Hour
ISO	International Organization for Standardization
Kw	Kilo Watt
LYD	Libyan Dinar
UNEP	United Nations Environment Programme
MEETMED	Mitigation Enabling Energy Transition in the Mediterranean region
MW	Mega Watt
MEPS	Minimum Energy Efficiency Performance Standards
MVE	Monitoring, Verification, and Enforcement
RCREEE	Regional Center for Renewable Energy & Energy Efficiency
RE	Renewable Energy
REAOL	Renewable Energy Authority of Libya
SEER	Seasonal Energy Efficiency Ratio
U4E	United for Efficiency
USD	United States Dollars

EXECUTIVE SUMMARY

Due to Libya's high dependence on fossil fuels, rapidly growing electricity demand, driven by population growth and urbanization, there is an urgent need for energy efficiency. Minimum Energy Performance Standards (MEPS) represent a critical regulatory tool that can help reduce electricity consumption, especially in the residential sector, which accounts for over 60% of total consumption and where a significant number of home appliances are used. This can be achieved by eliminating inefficient products and informing consumers' decisions through the energy efficiency labels placed on appliance.

This report supports the process of implementing effective MEPS and labeling programs for appliance in Libya, particularly for air conditioning units. It analyzes the electricity sector, examines the appliances market and regulatory landscape, identifies key challenges, and offers practical recommendations to promote efficient technologies in the Libyan appliance market.

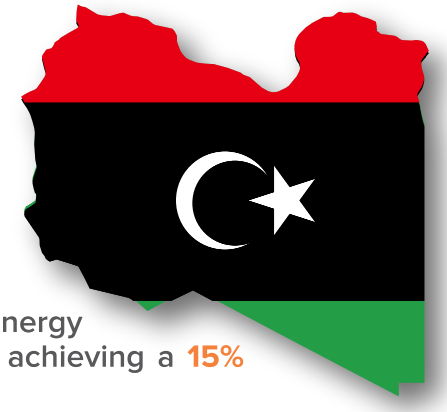
Key findings indicate that air conditioning units are a significant driver of electricity consumption and peak load, especially in the summer months. Despite the adoption of five MEPS for various appliances, a fully enforced MEPS and labeling program is not yet in place. Key challenges include the absence of a robust legal framework, limited public awareness, high electricity subsidies, and a shortage of skilled testing personnel.

To address these issues, key recommendations include: establishing a dedicated leadership entity to oversee MEPS and labeling implementation; developing and enforcing a robust legal framework to support the implementation of existing and future standards; enhancing coordination among all stakeholders; building a strong compliance system with clear monitoring, verification, and enforcement mechanisms; prioritizing the establishment of local accredited testing facilities; developing an online, centralized registry platform for appliances to track compliance and transparency; and conducting public awareness campaigns and capacity development programs.

1. INTRODUCTION

The Minimum Energy Performance Standards (MEPS) is a regulatory policy that establishes energy efficiency requirements for electrical equipment or appliances. These requirements set limits on the maximum energy consumption per unit. This means that any appliances that fail to meet these minimum energy performance requirements are prohibited from being imported or sold in the market. Therefore, the MEPS policy plays a crucial role in eliminating inefficient equipment from the market and reducing the availability of energy-consuming units.
In addition to MEPS, appliance labeling schemes are implemented to inform consumers about the energy efficiency of appliances. These labels aim to raise awareness about energy consumption, enabling consumers to make informed decisions and choose more energy-efficient options.

In December **2023**, **Libya** adopted a national strategy for renewable energy and energy efficiency for the period 2023-2035. This strategy aims to reduce the use of traditional energy sources and to increase the share of renewable energy in the generation mix to 4000 MW (20%) by 2035. Additionally, the strategy outlines several energy efficiency measures, including five initiatives focused on improving energy efficiency and rationalizing consumption, such as enhancing the energy efficiency of appliances. The strategy sets a target of achieving a **15%** reduction in energy consumption by **2027.**



As part of the **MEETMED** project and considering the absence of Minimum Energy Performance Standards (MEPS) for appliances in Libya, the Regional Center for Renewable Energy and Energy Efficiency (RCREEE) has chosen Libya to develop a MEPS program. This initiative aims to incorporate optimal mechanisms for implementing an effective MEPS and labeling program specifically for home appliances, with a particular focus on air conditioning units.

This report begins with an introduction that underscores the importance of implementing the Minimum Energy Performance Standards (MEPS) and labeling program, alongside an overview of the current situation. It then outlines the research methodology and analyzes electricity consumption across different sectors, including the usage of various appliances in Libya. Following this, the report reviews the current status of the MEPS and labeling process
the appliance market, and the relevant regulatory framework. It also addresses other key components of the MEPS and labeling process, such as **testing options, the appliance registration process, and implementation and compliance requirements**. The report concludes with recommendations for effectively implementing the MEPS and labeling program in **Libya.**

1.1 METHODOLOGY

For developing this report, a comprehensive literature review was conducted, covering national strategies, standards, and relevant legal and regulatory documents. Additionally, academic studies and research from trusted local institutions and international organizations were revewed. This was followed by the design of a detailed questionnaire and a series of interviews with key stakeholders involved in energy efficiency for appliances, aimed at bridging the knowledge gap and gaining insights into improving the current situation. The interviews included representatives from the Libyan National Center of Standardization & Metrology, UNDP-Libya, National Economic and Social Development Board. This report was developed in close coordination with the Renewable Energy Authority of Libya (REAOL).

2. OVERVIEW OF THE ELECTRICITY SECTOR IN LIBYA

The General Electricity of Libya (GECOL) serves as the sole power provider responsible for generating, transmitting, and distributing electricity. The electricity sector mainly depends on fossil fuels, with no integration of renewable energy sources into the grid so far. As reported by GECOL, around **47 GWh** of electricity was produced in **2023**, with over half of this amount generated from natural gas. The figure below illustrates the breakdown of electricity generation by fuel type.

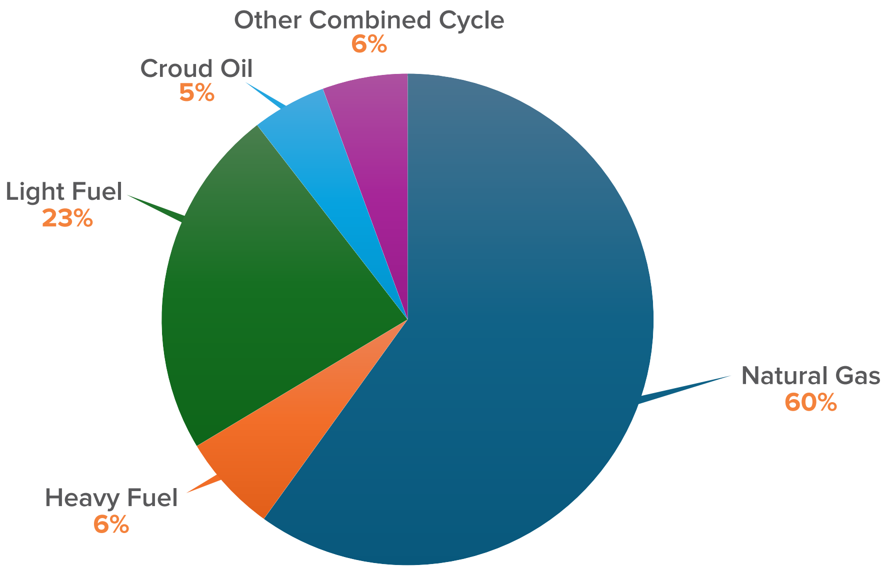


Figure 1: The Electricity Generated from Fuel Types

2.1 ELECTRICITY CONSUMPTION BY SECTORS

In terms of the electricity consumption and according to the General Electricity Company of Libya (GECOL), the total electricity consumption across sectors was 32.649 TWH in 2023. The residential sector accounted for over 60% of the overall electricity consumption in 2023. The consumption of other sectors was as follows: agriculture and industrial sectors at 7% each, commercial at 9%, public facilities at 11%, and public lighting 5% (see Figure 2)[1].

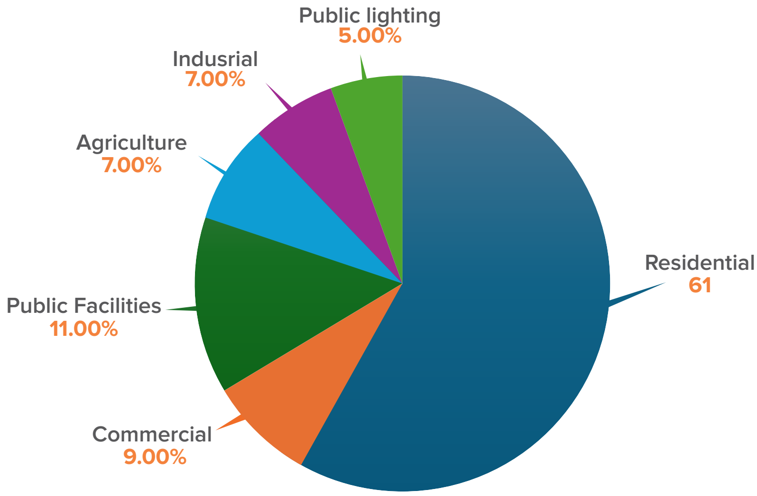


Figure 2: Electricity consumption by sector

It is also important to note that growing electricity demand, driven by population growth and increased economic activity, underscores the need for energy efficiency measures. These actions are essential to reduce the investment required to meet future demand and to align with international efforts toward environmental protection. Figure 2 shows population growth reached over 6.96 million in 2021, compared to 6.58 million in 2017. Electricity production increased to 40,731,187 MWh in 2021, up from 37,116,922 MWh in 2017[2], despite some fluctuations in electricity production levels.

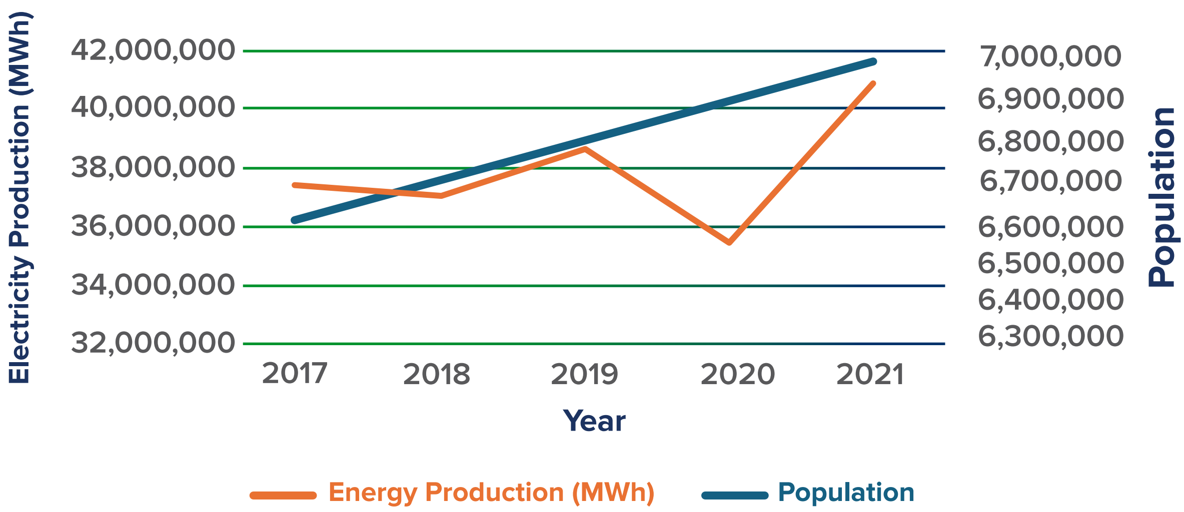


Figure 3: Electricity production vs. population growth [2]

The electricity demand growth rate in Libya was ranging from 5% - 7% before 2011 while it is higher in the following years. Figure 4 shows the electricity demand growth until 2023, which could reach up to around 20 GW[2]. Therefore, any improvement to energy efficiency would have a positive impact on the energy demand side and the financial situation of the country, amidst the challenges related to making significant reforms in the tariff.

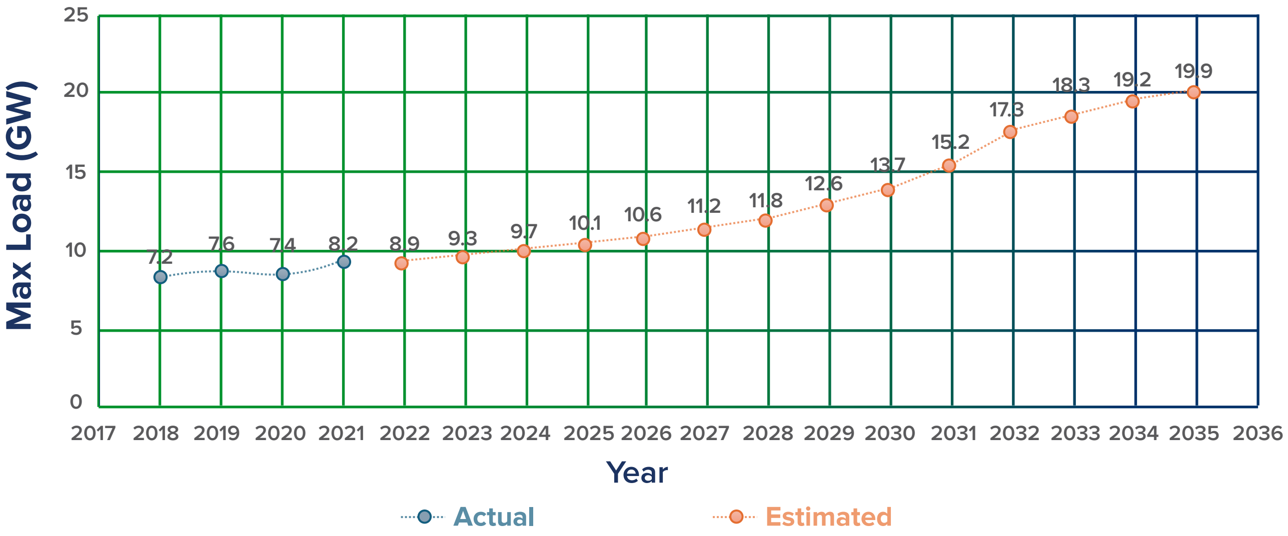


Figure 4: Actual and Estimated Electricity Demand Growth[2]

To address the high electricity demand in Libya, particularly during the peak summer months from June 15 to September 15, authorities reformed the electricity tariff for energy-intensive consumers, those using more than 0.5 MW, by applying a higher rate of 1 Libyan Dinar (LYD) per kWh (equivalent to 1000 Dirhams; 1 USD equals 4.8 LYD) per kWh. This measure led to significantly reducing the peak load in the summer. For the other sectors, the updated tariff ranging from 25-40 Dirham/kWh for residential sector to maximum 135 Dirham/kWh for public facilities and street lighting[3], which is heavily subsidized (see Table 1).

	Consumer Type	Dirham/kWh
1.	Households	40
2.	Households (with installments or salary)	25
3.	Commercial	80
4.	Light Industrial	60
5.	Heavy Industrial	45
6.	Public Facilities	135
7.	Street Lighting	135
8.	Small Farms	40
9.	Big Farms	45

Table 1: Tariff schedule as of 2023

2.2 ELECTRICITY CONSUMPTION BY APPLIANCES

Although there is no updated data regarding the appliance's electricity consumption, a study conducted in 2010 that addressed the appliances' electricity consumption in the residential sector shows that the air conditioning units account for 18.35% of total energy consumption. Notably, in 2010, water heating represented the largest share of energy consumption (30%). This is followed by lighting (22%) primarily due to the use of high-energy-consuming lamps, particularly for street lighting, [4]. However, it is expected that electricity consumption for lighting has since then decreased as several measures were implemented to phase out high-energy consumption technologies, such as tungsten-based lighting lamps. Figure 5 shows appliances' electricity consumption in 2010.

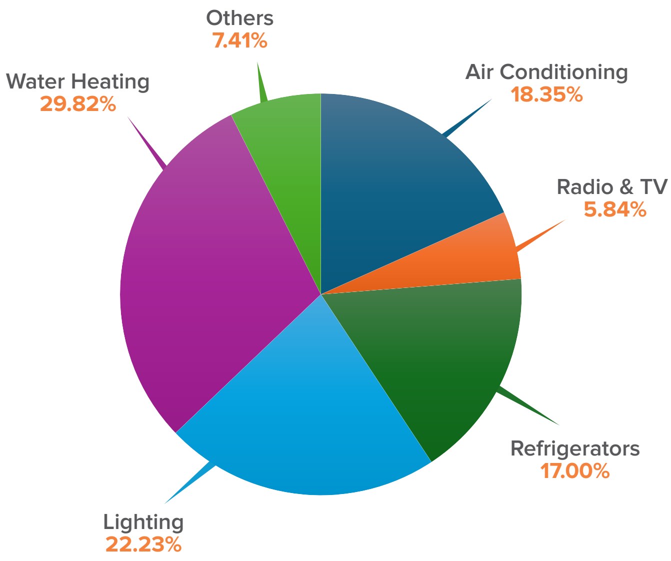


Figure 5: Electricity consumption per appliance in 2010 [4]

The substantial share of energy consumption by the appliances, especially within residential sector, represents a significant opportunity for reducing demand and achieving energy savings. The adoption of Minimum Energy Performance Standards (MEPS) would be crucial measure to promote the use of efficient equipment and reduce energy consumption in the appliances. Figure 6 illustrates the peak load period in 2023, showing that June and September are the highest demand for electricity[5], which are the hottest months of the year, when the use of air conditioning units significantly increases.

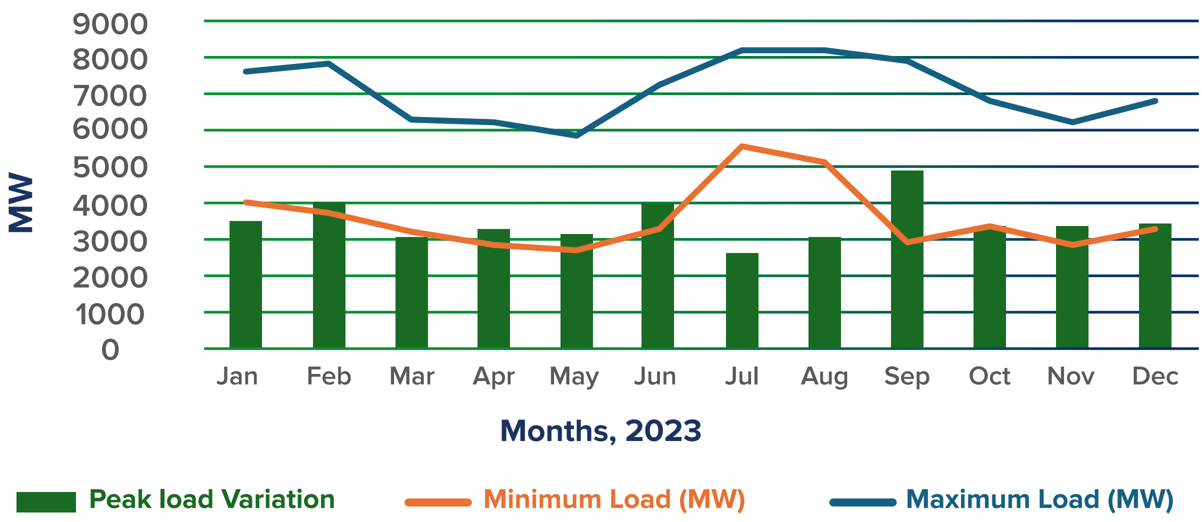


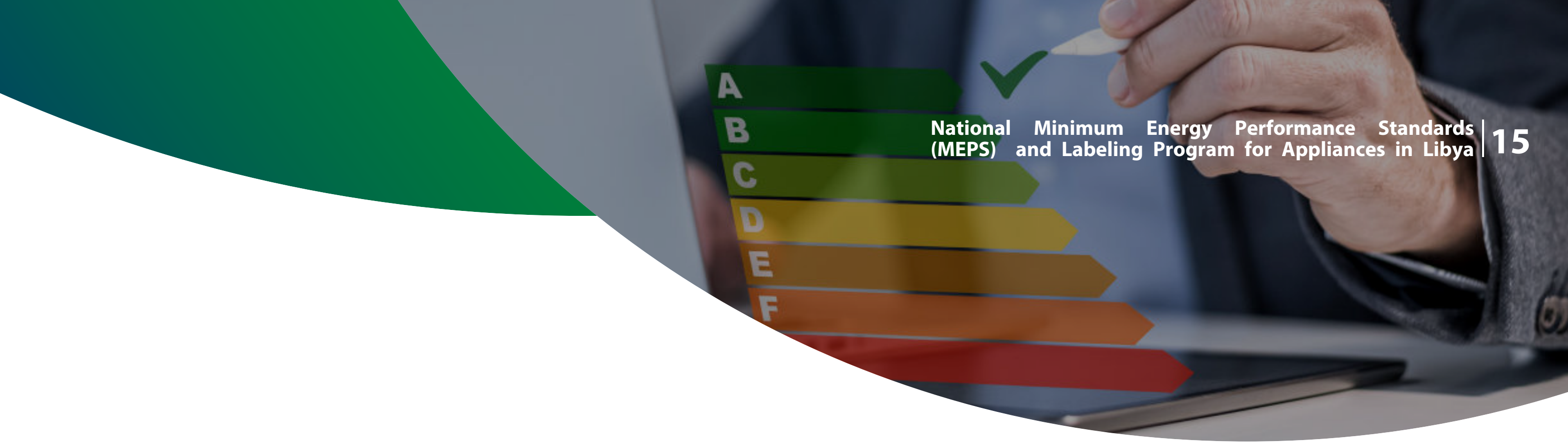
Figure 6: Maximum and minimum electricity load (MW) in 2023 [5]

According to the interviews, air conditioning units consume the highest share of residential electricity consumption currently, and it is estimated cooling load reaches around 1,700 MW, which could power around one million cooling units.

3. STATUS OF MEPS & LABELING PROCESS FOR APPLIANCES IN LIBYA

The Minimum Energy Performance Standards (MEPS), especially for home appliances, are among the most effective tools that can improve the energy efficiency performance of appliances. However, in Libya, there is no comprehensive and in place MEPS and labeling program for appliances. However, the national strategy for renewable energy efficiency of 2023 included a program, out of 5 energy efficiency-related programs, aims for adopting measures for implementing MEPS and labeling for electric devices. As per the 2023-2035 strategy, the program target five electric devices: air conditioning units, space heating, space cooling , 3-phase motors, and lighting. It is expected that this program can save up to 5.12% of potential energy saving by 2027. The strategy also tasked the Libyan National Center of Standardization & Metrology to lead the implementation process to achieve following activities[2]:

1. Reducing energy consumption of household appliances and industrial motors
2. Subjecting the appliance market to energy efficiency performance requirements
3. Issuing a legislation that requires the suppliers to use energy efficiency labels
4. Providing the necessary tools for market surveillance to ensure manufacturers adhere to national standards
5. Adopting standards for locally produced and imported equipment by the Libyan National Center of Standardization & Metrology.



In addition, **The Libyan** market is supplied with many appliances imported from different countries mainly: **China, Egypt, Korea, Italy, Turkey, and other countries.** There are no official statistics showing the volume of imports from each country. Therefore, having accurate information on the imported appliances and their energy performance levels are among the first steps to set the appropriate minimum energy performance standards and assess the expected impact of implementing the MEPS and Labeling program.
However, based on a regional study conducted in 2013 by the World Bank covered the Maghreb countries **(Libya, Morocco, Tunisia and Algeria)**, air conditioners (ACs) have become more widely accessible due to the fallen prices during the last few two decades. The **12,000** British thermal unit per hour (BTU/hr) is the most common AC size in Libya, and it cost ranges from $250 (in 2014, when USD1=LD1.25), around 32 of the consumers use 12,000 BTU/hr. Annual sales exceeded 2.85 million units in 2013, the sales in Libya accounts for 28 percent. Figure X illustrates the ACs in the Maghreb countries. It is noticed that Libya is the second largest market for ACs, after Algeria [6].
The ACs with power demand of **12,000** British thermal unit per hour (BTU/hr) are THE most common type of ACs in Libya. Tje estimated annual sales exceeded 2.85 million units in 2013 in the region, while the sales in Libya accounts for 28 percent. **Figure 7** illustrates the annual sales in the Maghreb countries. It shows that Libya is the second largest market for ACs.

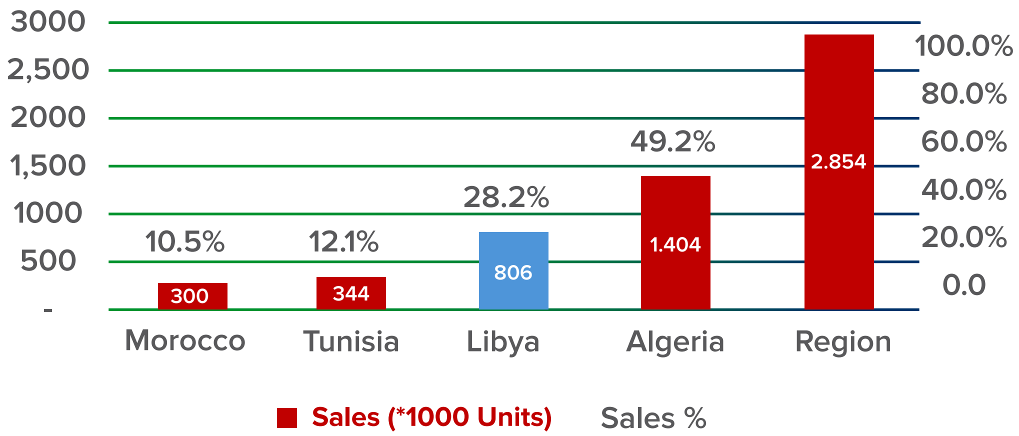


Figure 7: Annual sales of ACs in 2013 [6]

The ACs in Libya are exclusively imported as finished goods and are sold within the local market or exported to neighboring countries. **Table 1** outlines the key brands and their respective market shares observed in Libya as per 2014 data. It is clear that the brand ‘General’ had the largest share at that time.

Brand	General	V5	Sax Weel & Concord
Market share (%)	57	11	9

Table 2: Market shares of the key brands of air conditioning in Libya in 2014

Based on recent research developed by the Libyan Centre for Solar Energy Research and Studies, published in 2023, the General brand and the cooling power demand of 12,000 Btu/hr in addition to 18,000 Btu/hr still have the highest share in the market and commonly used. Figure 8 shows the results of the survey for the purpose of the survey, it revealed that the most common types of air conditioning units are used by consumers. Only ACs with 1% usage rate and more were stated out of more than 31 brand names that were mentioned by the respondents.

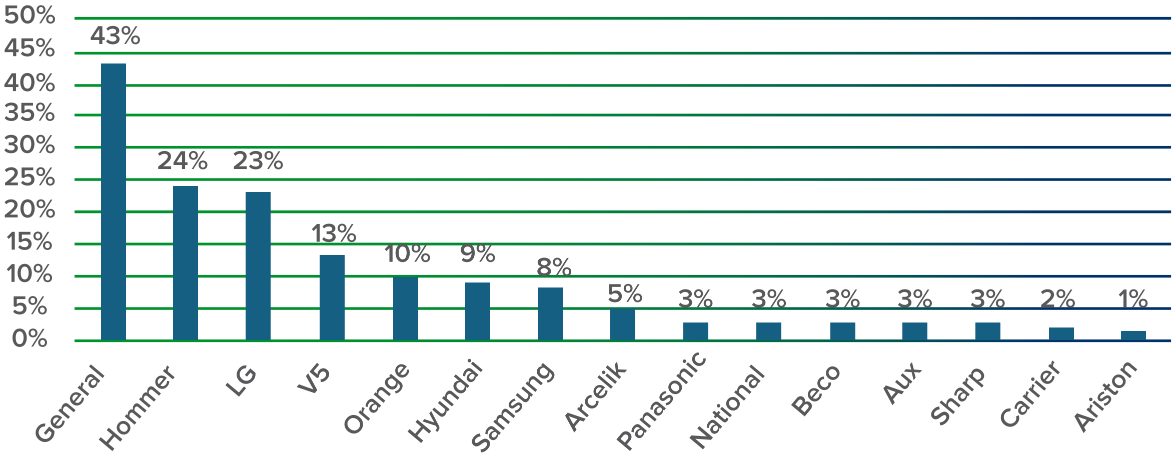


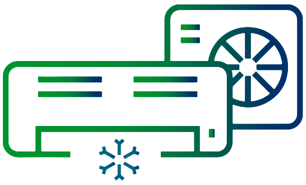
Figure 8: The most used air conditioners and the percentage of use per type [7]

In terms of the people's awareness of energy efficient appliances, significant number of the people do not have sufficient knowledge about minimum energy efficiency performance and energy efficiency labels and their roles to direct people to purchasing behaviors. Therefore, people often make their decision mainly on the price and on the brand's popularity rather than electricity consumption of the appliances.

4. REGULATORY FRAMEWORK

Having robust regulations is essential for the successful implementation of energy efficiency measures. These regulations provide technical guidelines for different sectors and can establish necessary foundation to support the development of energy efficiency policies. So far, no independent and dedicated body focuses mainly on the national energy efficiency strategies and policies at the country level. However, the national strategy for renewable energy and energy efficiency aiming to establish such a body concerning for promoting energy efficiency practices in Libya.

In the field of appliances, two key regulations need to be established: one for the Minimum Energy Performance Standards (MEPS) and one for energy efficiency labeling process. For the case of Libya, there is a need to have enforced regulations that ensure that appliances meet minimum energy performance requirements and provide consumers with information about the energy efficiency of appliances through clear labeling process.



Recently, in 2022, the national committee that was formed by the National Economic & Social Development Board, under decree No. 74 of 2022, developed a MEPS for the window and split air conditioning units with cooling power demand under 70,000 Btu/h. The Libyan National Center of Standardization & Metrology's supreme committee then adopted the MEPS in the same year under the decree No. 1 of 2022 However, in terms of the actual implementation it is still not effective until the time of writing this report.

As per the standards, the label is supposed to include grades A to G, where A (dark green) refers to the highest energy efficiency and G (dark red) to the lowest energy efficiency. The standard shows that the metric that is used is energy efficiency ratio (EER) starting from 11 Btu/hr/Watt as the lowest energy efficiency that is acceptable to be enter the market. Table 3 shows the Energy efficiency grades with the correspondent colors and EERs[8].

Energy Efficiency Level		Label Colors	Energy Efficacy Limits (EER) Btu/hr/Watt
A	أ	Dark Green	EER ≥ 16.0
B	ب	Green	16.0 < EER ≥ 15.0
C	ج	Light Green	15.0 < EER ≥ 14.5
D	د	Yellow	14.5 < EER ≥ 14.0
E	هـ	Orange	14.0 < EER ≥ 13.5
F	و	Red	13.5 < EER ≥ 12.5
G	ز	Dark Red	12.5 <EER ≥ 11

Table 3: Energy efficiency grades with the correspondent colors and EERs

Although several countries are moving toward using advanced metrics to accurately evaluate energy efficiency, i.e., the Seasonal Energy Efficiency Ratio (SEER), which tests ACs at different temperature points, rather than the EER, which uses only one point, it would be beneficial to begin with the developed standard in Libya as a first step, with a plan to upgrade to SEER in the future. It is also recommended to ensure that the Minimum Energy Performance Standards (MEPS) reflect on-the-ground conditions to avoid setting efficiency standards that are either too high to be attainable or too low, where the existing market already exceeds them. This can only be determined after surveying the efficiency levels currently available in the market. In addition to that, the MEPS needed to be continually upgraded to reflect EE level in the market that pushes the market for better energy efficient ACs.

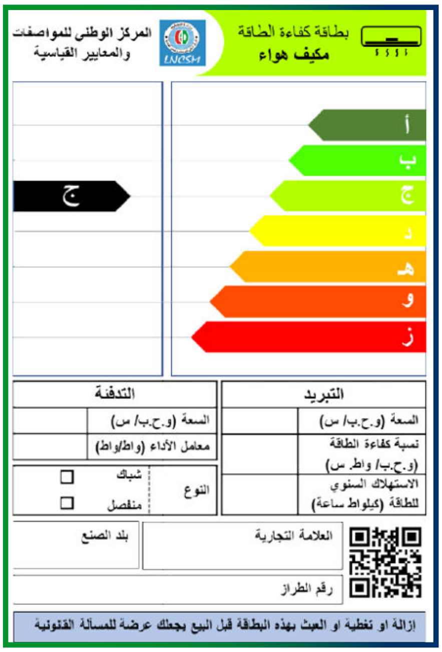


Figure 9: Proposed Label for ACs in Libya

According to an interview with REAOL, the authorities have recently started enforcing the MEPS, relying on certificates issued by laboratories outside Libya since there are currently no local testing facilities in Libya. Regarding the labeling process, the proposed standards suggested issuing customized EE label for the ACs in place. The implementation of have a local label that is planned to be issued by Libyan National Center of Standardization & Metrology. The figure below shows the planned label.

In addition to AC standards, it is worth noting that Libya also adopted other standards for lightings, refrigerators and freezers, electric ovens and electric heaters [9], see Table 4. In addition, there is a plan to develop standards for washing machines, dishwashers & dryers is developing - as well as central air conditioning units. However, the missing part of the process is still the enforcement of these standards.

Countries		Lighting	Fridges and Freezers	ACs	Washing Machine	Dishwasher	Solar Water Heater	TVs	Electric Oven	Vacuum Cleaner	Electric Heaters	Laundry Dryer	Fans
Libya	MEPS												
	Labels												

Adopted but it was not enforced yet

Under preparation

Table 4: Status of MEPS and labels in Libya

5. APPLIANCES TESTING

One of the critical components of the MEPS program is establishing a testing facility to assess the energy efficiency of appliances that are either locally manufactured or imported. This ensures that appliances sold in the market comply with the energy performance standards. As Libya currently lacks national testing facilities for appliances, several options need to be considered for conducting this crucial testing process:

First Option
Building a National Facility

Establishing a national testing facility dedicated to energy efficiency testing of appliances. This facility would be managed by relevant government bodies in Libya to ensure that testing is done locally and in accordance with Libyan regulations and standards. Although this would provide full control over the testing process and foster the development of technical expertise within the country, it requires significant investment in infrastructure, equipment, and skilled personnel. Table 5 shows the estimated capital and operational costs for establishing a local laboratory [10].

Item	Estimated Cost (USD)	Description
Capital Costs		
Air Conditioner-Specific Equipment	350,000 - 650,000	Room calorimeter, control air space chamber, compressor condensing units, air handling unit, humidifiers, pressure equivalence devices, water calibration system, air sampler and psychrometer box (complete setup and commissioning)
Generic Equipment (usually pre-owned)	3,000 - 5,000	Voltage stabilizer, thermometer, hygrometer, sampler, etc.
Accreditation	5,000	For accreditation by International Organization for Standardization ISO 17025
Inter-Laboratory Trials	5,000	For calibrating proficiency
Total	363,000 – 665,000	
Operational Costs and Requirements		
Staffing	2	At least two trained personnel
Space	60 m2	Minimum area required
Equipment, calibration and maintenance	10,000	Per annum
Additional operating costs: capacity building, staff training, re-accreditation, re-certification	2,000	Per annum

Table 5: Capital and operational cost for establishing a local laboratory

2 Second Option
Allowing the Private Sector to Provide Testing Services

Another approach would be to engage the private sector to provide testing services for appliances. Private investors could establish and operate testing facilities and offer flexibility and potentially faster implementation. However, to ensure credibility and compliance with international or local standards, it is essential that these private testing facilities are accredited by a recognized accrediting body. This body could be local or international, ensuring that testing results are reliable and meet the required technical and procedural standards.

3 Third Option
Collaborating with Neighboring Countries

Given that Libya is close to other countries with established testing infrastructure i.e., Egypt and Tunisia, it may be viable to collaborate with neighboring countries that already have accredited testing facilities. This option would allow Libya to leverage existing resources and expertise, which in turn would reduce the need for significant investment in constructing local facilities. However, this approach may involve testing protocols and logistical challenges, and it will require coordination between countries.

4 Fourth Option
Using Certifications from International Testing Facilities

Finally, Libya could consider accepting certifications issued by trusted international and accredited testing facilities. There are many international testing organizations that are reputable and follow protocols for energy efficiency testing. By using these internationally recognized and certified facilities, Libya can ensure compliance with energy performance standards without the need for a local testing facility.

According to the interviews, there is also a discussion with a development partner to finance establishing a testing facility. However, securing funds for establishing a testing facility represents a significant challenge.

6. IMPLEMENTATION PLAN

Implementing a MEPS and labeling program in **Libya** requires a strong and comprehensive action plan that addresses all necessary steps and includes strategies for mitigating potential risks. The inception phase should establish a legal framework, appoint an administrative body or regulator to oversee the process, and engage relevant stakeholders, including government institutions and private sector actors such as suppliers, importers, and manufacturer representatives. It is also essential to determine viable options for testing imported products (see Section 5). For effective implementation, a thorough understanding of the appliance market is required, including data collection on available products, costs, brands, sources, and efficiency levels. Assessing the economic impact of the MEPS and labeling program is another critical step to for understanding the viability of the program. It is also recommended to harmonize MEPS with similar programs in comparable contexts. Finally, there is a need to establish appropriate efficiency standards, clarify the testing procedures and protocols and address the issues related to the labeling process. As with any program, ongoing evaluation and improvement will enhance its effectiveness. Figure 10 outlines the key steps to consider in MEPS implementation.

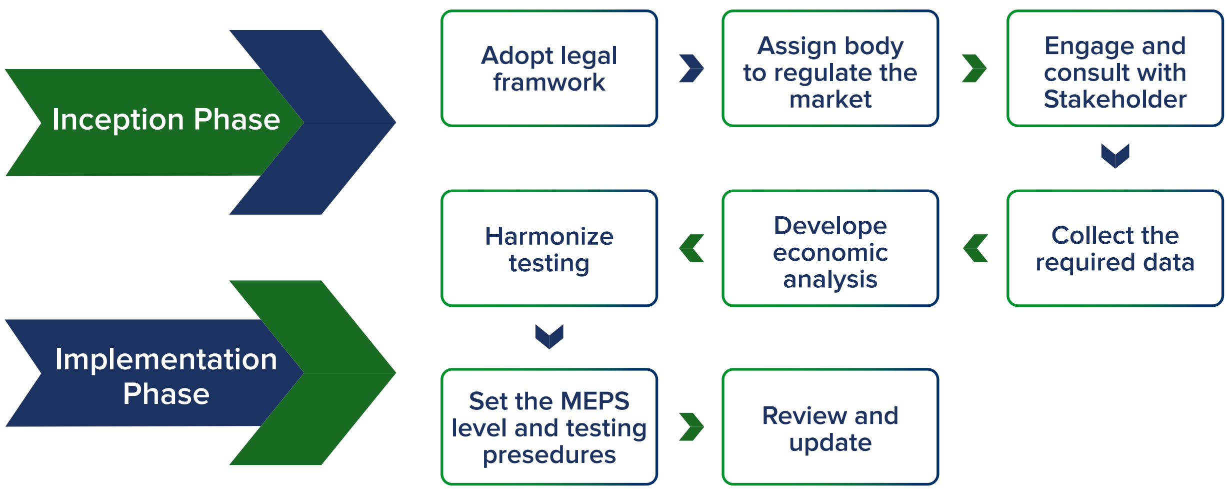


Figure 10: MEPS implementation steps

For the successful implementation of the MEPS and labeling program it is important to engage all the relevant stakeholders who may influence the program implementation. The stakeholders include the public sector, private sector, research centers and universities, and other relevant organizations. Table 6 lists the main stakeholders and their roles.

Stakeholders	Role
Libyan National Center of Standardization & Metrology	The National Center for Standards and Metrology is the national body exclusively concerned with preparing, updating, adopting and issuing Libyan standard specifications. It is a national scientific research body specialized in standardization activities including specifications, quality assurance, and calibration, which are activities directly concerned with consumer protection, health and safety, and environmental preservation.
Ministry of Economy and Trade	Oversees national economic policy, and aims to drive sustainable development, diversify the economy, and promote investment. It regulates trade, monitors market activities, supports private sector growth and economic reforms to improve financial stability and job creation.
The Industrial Research Center	The Industrial Research Center is the main body concerned with developing the national economy in the State of Libya in all aspects of industrial research to enhance the technical research capacity that aims to expand the use of local materials, resources and raw materials in industry. It is considered the main body in implementing the development plan. The center receives samples for analysis and to ensure their compliance with specifications. It follows up on the analysis and ensures the analysis requirements with the concerned authorities according to the circumstances of each sample.
Libyan Customs Authorities	Responsible for imports and imports in the country. It can play an important role in enforcing MEPS for imported appliances.
Renewable Energy Authority of Libya (REAOL)	Responsible for renewable energy deployment in Libya. One of its mandates is to enhance energy efficiency in the country.
General Electricity Company of Libya (GECOL)	The main electricity power utility in Libya. It is responsible for electricity generation, transmission, and distribution.
Ministry of Planning	The main sovereign body is responsible for country planning. It plays an important role in developing and approving the national strategies and plans.
Ministry of Finance	The Ministry of Finance is responsible for developing and implementing financial policies. It also prepares the public budget of the State in cooperation with Ministries and Government Agencies and directs government investment in line with the financial policies of the state among other relevant activities.
National Economic & Social Development Board	It is a consultancy body which aims to support the government in policy formulating. The board is working on several areas including renewable energy and energy efficiency related activities.
Private sector	The private sector institutions that are involved in the appliances market, e.g., importers, chambers of commerce, and similar entities.
Universities and research centers	The institutions that have researchers, experts, and students whose role is limited to providing technical assistance, studies, and consultancy concerning the deployment of energy efficiency practices.
Non-governmental organizations	The international and local non-governmental organizations who work on energy efficiency areas, e.g., those provide technical assistance, capacity building, etc.

Table 6: Key stakeholders

7. COMPLIANCE PROCESS

To ensure compliance with the requirements of the MEPS and labeling Program for appliances, there are three key aspects that need to be achieved, as outlined by UNEP-U4E [11]:

Conformity Assessment: This requires suppliers and authorities to undertake specific steps to ensure appliances comply with Minimum Energy Performance Standards (MEPS) and labeling requirements before they enter the local market. These steps include performance testing, declaration of performance, and documentation of the assessment. Compliance also includes inspection and recording through processes such as product registration, market surveillance, and enforcement.

Market Surveillance: This process, carried out by relevant authorities, ensures that products on the market meet regulatory requirements. Market surveillance includes monitoring, verifying, and reporting. Its primary goals are to ensure that:

- Appliances display energy labels with accurate information.
- Energy performance and technical specifications align with the claimed performance and regulatory requirements.
- Products are registered in accordance with regulations.

Enforcement: Effective enforcement strategies are essential for upholding the integrity of MEPS and labeling programs. While market surveillance/monitoring and verification testing are crucial, robust enforcement procedures are necessary to address potential non-compliance, non-conformity, such as at the point of import, during product placement on the market, during testing, at the point of sale, or following initial enforcement action. These actions are essential to achieve the desired benefits of the MEPS and labeling process and ensure a free and fair market for legitimate suppliers[11].

In other words, a similar approach to enhance the effectiveness of the MEPS and labeling program can be enhanced by Monitoring, Verification and Enforcement (MVE)[12]. In terms of the corrective actions for enforcement, it typically starts with simple and soft measures such as warning to fix the issue and can be escalated to fines, suspension of operating licenses and prosecution. Figure 11 shows the levels of enforcement escalation.

Figure 11: Levels of enforcement escalation [11]

7.1 REGISTRATION PROCESS

The establishment of a registration platform for appliances is a crucial step for ensuring an effective implementation of the MEPS and labeling program in **Libya.** It serves as a tool for Monitoring, Verification, and Enforcement (MVE). Such a platform offers advantages, as outlined by U4E [13]:

- Creates a comprehensive database of appliance information to support the development of relevant policies.
- Monitors which products are available and sold in the market and ensure compliance with national energy efficiency standards and policies.
- Enables policymakers to access data, track efficiency trends, and assess the environmental impact of appliances.
- Empowers consumers to make informed decisions by accessing the database to compare the energy efficiency of available products.

For Libya, the current registration process requires importers to submit various forms in hard copy as part of the adopted standards. Therefore, transitioning to an online registration platform would provide Libya with the benefits mentioned above and would improve efficiency and transparency in the monitoring of energy-efficient products.

Currently, the registration process for obtaining the labels for ACs requires the importers to submit several filled forms, **including the following:**

- Information about the applicant: importer name, company name, address, number of the commercial register and import clearance
- Details on the products: type of ACs, model number, manufacturing country and production date
- Testing report: type of testing facility, name and address of the testing facility, accreditation body, testing standards and electrical parameters used for testing, testing date, etc.
- Specific specifications for product: including product dimensions, type of ACs (cooling, heat pump, cooling and heating), type of electricity supply used (1-phase, 3-phase or direct current), type of refrigerant used
- Details on energy performance: testing results for the colling and heating performance and the EER level

After submitting all the required documents and information, the energy efficiency label is granted for placement on the products.

8. KEY CHALLENGES FACING MEPS AND LABELING PROGRAM IN LIBYA

Although that Libya has taken steps toward implementing a MEPS and labeling program, there are still several challenges facing its implementation in **Libya.** The following list illustrates **the main challenges:**

1. Lack of a legal and regulatory framework for energy efficiency measures for appliances.

2. Absence of a dedicated entity focused on promoting energy efficiency practices

3. High subsidies for electricity tariffs, which led to excessive energy consumption, therefore, making investments in energy efficiency measures less attractive.

4. Limited public awareness of the importance of the MEPS and energy efficiency labels

5. Scarcity of information on the appliances market.

6. Insufficient coordination among relevant institutions and a lack of comprehensive programs and enforcement tools to implement, monitor, and evaluate energy efficiency measures, especially MEPS for home appliances.

7. Shortage of skilled and experienced personnel for tasks such as testing and certification.

9. CONCLUSION AND RECOMMENDATIONS

In conclusion, the implementation of MEPS and a labeling program for appliances, especially for air conditioning units, is crucial for reducing electricity consumption in the residential sector and enhancing the overall energy efficiency in Libya. The electricity consumption pattern underscores the urgent need for these measures, particularly in the residential sector, which accounts for over 50% of total consumption. Enforcing MEPS and labeling can phase out inefficient appliances, thereby reducing overall demand.

The national strategy for renewable energy and energy efficiency (2023 to 2035) outlines several measures that aim at achieving significant reductions in energy consumption, including a MEPS and labeling program for five key appliances: air conditioning units, space heating, cooling systems, three-phase motors, and lighting. Lately, five energy efficiency standards have already been adopted for llighting, refrigerators and freezers, ACs, electric ovens, and electric heaters. However, the lack of effective enforcement mechanisms remains a key challenge, among others. Moving forward, several actions need to be conducted, **including:**

- **Enhancing the institutional framework related to energy efficiency:** Establish or assign an entity to lead the MEPS and labeling program in Libya.

- **Establishing legal and regulatory framework:** Develop a robust legal foundation to support the enforcement of existing energy efficiency standards. This framework should also pave the way for adopting additional standards for a wider range of appliances that currently lack standards. **Priority** should be given to the standards that have already been adopted and are included in the 2023–2030 strategy, specifically for lighting, refrigerators and freezers, air conditioners, electric ovens, electric heaters, and space heating and cooling systems.

- **Strengthening stakeholder coordination:** Enhance collaboration among key stakeholders by clearly defining roles and responsibilities.

- **Securing necessary resources:** Ensure the allocation of necessary resources to facilitate effective implementation and oversight of energy efficiency measures for appliances.

- **Establishing a strong compliance framework:** develop a detailed compliance framework that includes monitoring, verification, and enforcement processes, this includes assigning responsible entities for each aspect of compliance and identifying appropriate corrective actions for instances of non-compliance or violations.

- **Conducting public awareness campaigns:** Launch targeted campaigns to educate consumers about energy efficiency labels. Promote informed purchasing decisions by emphasizing the advantages of energy-efficient and high-quality products. The awareness messages can be disseminated through social media, TV and Radio, etc.

- **Conducting capacity development program for stakeholders:** Develop and implement training programs for relevant stakeholders such as customs officials, suppliers, and importers. Such training programs should focus on the practical aspects of implementing and complying with the already adopted energy standards, these could be led by the institution(s) that developed the standards (e.g., the Libyan National Center for Standardization and Metrology). Additionally, focused capacity development activities are needed for technical staff involved in testing, among other areas.

- **Establishing testing laboratories:** Establish a local and accredited testing laboratory to assess the energy performance of appliances to ensure compliance with the adopted standards.

- **Developing an appliance registry platform:** Develop a centralized registry platform for registering and tracking appliances in the market, which will also facilitate monitoring, compliance, and transparency regarding energy performance.

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