STRATEGIC PROGRAM TO PROMOTE RENEWABLE ENERGY AND ENERGY EFFICIENCY INVESTMENTS IN THE ELECTRICITY SECTOR OF SAO TOME AND PRINCIPE

CONCEPTUALIZATION OF A LABELING PROGRAM FOR LIGHTING, AIR CONDITIONERS AND REFRIGERATORS IN SAO TOME AND PRINCIPE

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SUMMARY

LIST OF ACRONYMS

AC	Air Conditioning
AFAP	Agência Fiduciária de Administração de Projectos em São Tomé e Príncipe
AfDB	African Development Bank
AGER	General Regulatory Authority
AENER	Santomean Association of Renewable Energies
ARP	Autonomous Region of Principe
ATEFER	Association of Cold Technicians and Renewable Energies
BSTPPTC	Brazil-São Tomé and Príncipe Professional Training Centre
CCI	Chamber of Commerce and Industry
DGA	Directorate General of Environment
DGRNE	General Directorate of Natural Resources and Energy
DRCAE	Directorate for Regulation and Control of Economic Activities
ECCAS	Economic Community of Central African States
EDP	Energias de Portugal (EDP)
ECGCF	Green Climate Fund
ECOWAS	Economic Community of West African States
EE	Energy Efficiency
EER	Energy Efficiency Rate
EMAE	Water and Electricity Company
IDDA	Industrial Development Decade for Africa
ISO	International Organization for Standardization
GEF	Global Environment Facility
INA	International Fund for Agriculture
LDCs	Least Developed Countries
LED	Light-Emitting Diode
MEPS	Minimum Energy Performance Standards
MIRN	Ministry of Infrastructure and Natural Resource
MNECC	Ministry of Foreign Affairs, Cooperation and Communities, São Tomé and Príncipe
NGO	Non-governmental organization
PANA	National Climate Change Adaptation Plan
PANEE	National Energy Efficiency Action Plan
PANER	National Renewable Energy Action Plan
PIQAC	Quality Infrastructure Programme for Central Africa
PNDS	National Sustainable Development Plan of the STP
RECs	Regional Economic Communities
RES	Renewable Energy Sources
SENAPIQ	National Service of Intellectual Property and Quality
SIDS	Small Island Developing States
SMEs	Small and Medium Enterprises
STP	Sao Tome and Principe
TESE	Association for Development
UNDP	United Nations Development Program
UNEP	United Nation Environment Program
UNIDO	United Nations Industrial Development Organization

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INTRODUCTION

São Tomé and Príncipe (STP) is a country consisting of two main islands situated in the Gulf of Guinea, that has an exclusive economic zone of 160,000 km^2 and is a member of the Economic Community of Central African States (ECCAS).

With an area of 1001 km^2, STP is part of the Small Island Developing States (SIDS), which means that STP is facing different challenges, due its size, its remoteness, its low economic development level, and part of the list of least developed countries (LDCs).

The country has developed the following documents to guide its economic growth:

- *2030 Vision: "São Tomé e Principe 2030: the country we need to build"*, which aims to develop a climate-resilient island, a blue economy, financial and touristic serviced.
- *National Development Plan (PNDs) 2020 – 2024*, which has the Government Program as the basis for its conception and elaboration and aligns with the United Nations 2030 Agenda for sustainable development, the accelerated implementation modalities of the Samoa Roadmap and the 2063 Africa We Want Agenda

The aim is to develop a climate resistant archipelago, and therefore it is necessary to develop its energy sector, especially the electricity sector, to develop renewable energy sources (RES) and improve energy efficiency.

The success of these policy documents depends heavily on a reform of the energy sector and a transformational shift of the entire energy system from an almost complete reliance on imported fossil fuels to renewable energy and energy efficiency. Such a transition will lead to a significant reduction in fossil fuel import costs and free up scarce monetary resources for social and economic development (e.g., education, health, transport, export diversification, development of Small and Medium Enterprises (SMEs) and adaptation to climate change). In addition, it will help the island's main industries and income generating activities (e.g., water supply, agriculture, food processing, tourism, fisheries and the blue economy in general) to become more productive and competitive.

To answer these challenges, several projects are also on the way, for instance the Global Environment Facility (GEF) project *"Strategic program to promote renewable energy and energy efficiency investments in the electricity sector of São Tomé and Príncipe"*. A Green Climate Fund (GCF) funded by the UNIDO project *"Building institutional capacity for a renewable energy and energy efficiency investment programme for Sao Tome and Principe"*, is currently under final approval.

This UNIDO project aims to decrease electricity demand-side losses, thanks to the introduction of a well-proof mechanism, **the MEPS (Minimum Energy Performance Standards) and energy labels, for three main electric appliances: lighting, air conditioning (AC) and refrigeration.**

The promotion of energy efficiency measures can offer great opportunities early on, to reduce overall electricity demand and peak electricity demand. It will also enable electricity to reach out to a greater proportion of the population and improve the economic activities in the country.
It is expected that the successful implementation of minimum energy performance standards (MEPS) and a corresponding labeling scheme will:

- Reduce electricity peak demand and thereby reduce the pressure on the electricity network. Also, the new electrification plans being developed will reach a higher percentage of the population, and consequently reduce government future public expenditures;
- Reduce overall electricity consumption and bills for consumers, who will spend a smaller fraction of their incomes on energy. This is especially important for low-income households, for which the high price of electricity is a barrier to meeting their basic needs;
- MEPS and labeling of household appliances can serve as a powerful tool to inform consumers about differences in energy performance. This will direct consumers towards purchase of more efficient appliances.

The overall objective of the project is to contribute to increasing national capacity to uptake energy efficient appliances in compliance with quality standards.

1 EXECUTIVE SUMMARY

The project aims to decrease electricity demand-side losses in São Tomé and Príncipe, thanks to the introduction of a well-proof mechanism, the Minimum Energy Performance Standards (MEPS) and energy labels, for three main electric appliances: lighting, air conditioning and refrigeration.

This report presents:

- The design of informative labels for appliances,
- The testing procedure for each appliance,
- The labeling threshold and a range for each labeled appliance,
- The methodology for the program implementation.

O projeto visa diminuir as perdas do lado da procura de eletricidade em São Tomé e Príncipe, graças à introdução de um mecanismo bem provado, as Normas Mínimas de Desempenho Energético (MEPS) e etiquetas energéticas, para três aparelhos elétricos principais: iluminação, ar condicionado e refrigeração.

Este relatório apresenta:

- *O design de etiquetas informativas para eletrodomésticos,*
- *O procedimento de teste para cada aparelho,*
- *O limite de rotulagem e um intervalo para cada aparelho rotulado,*
- *A metodologia para a implementação do programa.*

2 OBJECTIVES OF THE REPORT

This report presents the labeling program.

The labeling program for lighting, air conditioners, and refrigerators provides informative labels to imported/manufactured products. Labels are attached to household electric appliances like light bulbs, ACs and equipment like cars to show primarily the energy consumption. Some might include comfort and environmental related information regarding the products. This information is directed to the consumers who can very easily visualize and make substantiated decisions based on the EE of the product. Experience shows that labels help shift sales towards energy efficient products making energy inefficient products disappear from the market.

This labeling program is designed for lighting, air conditioners, and refrigerators. It provides informative labels to imported/manufactured products. Labels are mandatory (from some point in time) on all products sold in the country.

To do that, information at the regional, African and international levels (particularly of lusophone countries) has been taken into consideration in order to contribute to the potential trade in energy markets. The labeling program has been based on international best practices and presented for adoption. It considers experiences applied at the regional level (Central Africa, SADC, EAC) and particularly lusophone countries (e.g.Portugal, Cape Verde, Brazil).

The information on the label is based on the context conditions identified in the baseline assessment report.

The development of a mandatory labeling scheme was developed with the collaboration of the Technical Committee (TC) and all the stakeholders.

The results of the workshops regarding labelling program

Two validation workshops have been organized for validation and harmonization of MEPS and labeling program. The main conclusions of the workshop are briefly presented:

- On the matter of labels, all of the groups agree that the bar-type label should be adopted, for the reasons that they already are circulating in STP and therefore are easier to understand. Another reason for this choice was its popularity, and that it suits the reality of the STP market.
- On the matter of testing procedures, all groups agreed that both methods for testing (documentation check & lab testing) are deemed important for controlling imported appliances and whether they are acceptable for STP.
- For the implementation plan, several groups had some activities to add and also provided comments and suggestions on who else can be involved.

A separate report is dedicated to the presentation of the results of the workshops.

All results are further explained in chapter 4.2 of this report.

This labeling program involves:

- *Design of informative labels for appliances*

This activity is based on the forecast of the energy efficiency potential of selected appliances and an analysis of the proposed energy labels. The information provided by the energy label should facilitate a simple choice of electric appliances.

- *Selection of a testing procedure for each appliance*

For each appliance, we have identified and described the test procedure required by the selected devices. For example, an air conditioner requires a calorimetric chamber. This activity consists of identifying the test procedures to be adopted by STP.

- *Establishment of a labeling threshold and a range for each labeled appliance*

This report also contains an analysis of the energy efficiency of appliance in order to assess the energy efficiency potential and prescribe an appropriate threshold based on the results.

- *Definition of a methodology for the program implementation*

3 REVIEW OF EXISTING LABELING PROGRAMS

This benchmarking (made in parallel with the work on the MEPS) has been undertaken, to establish an inventory of the latest existing labels used around the globe. Attention has been paid to labels existing in the EU, at regional level (Ghana, Nigeria, Benin, etc.), in lusophone countries (e.g., Portugal, Cape Verde, Brazil) as well as Asia (India, China, Thailand, Vietnam).

3.1 Label in the European Union

The European Union introduced categorical labeling for household appliances in 1992, with a directive that established the A to G scale and the general design of the EU Energy Labels that is still used today. Soon after the first establishment of the Energy Labels, a major problem appeared. There was an excessive amount of products that populated the highest scales, whereas the lower classes were nearly empty. In order to restore a balance, the EU, with a 2010 Directive, rather than rescaling the energy labels, or radically reviewing the parameters of its MEPS, expanded the scales and introduced the 'plus scales', i.e. A+, A++, and A+++. Shortly after, it became evident that the initial problem of products overpopulating the highest scales of the Energy Labels, that the 2010 Directive attempted to solve, had not been addressed in an adequate way. Not only that, but market research as well as a series of consumer questionnaires and other qualitative research showed that the "plus scale" were deemed as not useful and not efficient for categorizing products effectively, while the initial 'A to G' scales were favored by consumers as they were deemed as clearer and more meaningful. Therefore, the European Commission introduced a revised legal framework for the energy efficiency label in 2017, which re-instated the A to G scale, along with stricter, and dynamically adjustable rules about the energy classes definition and classification.

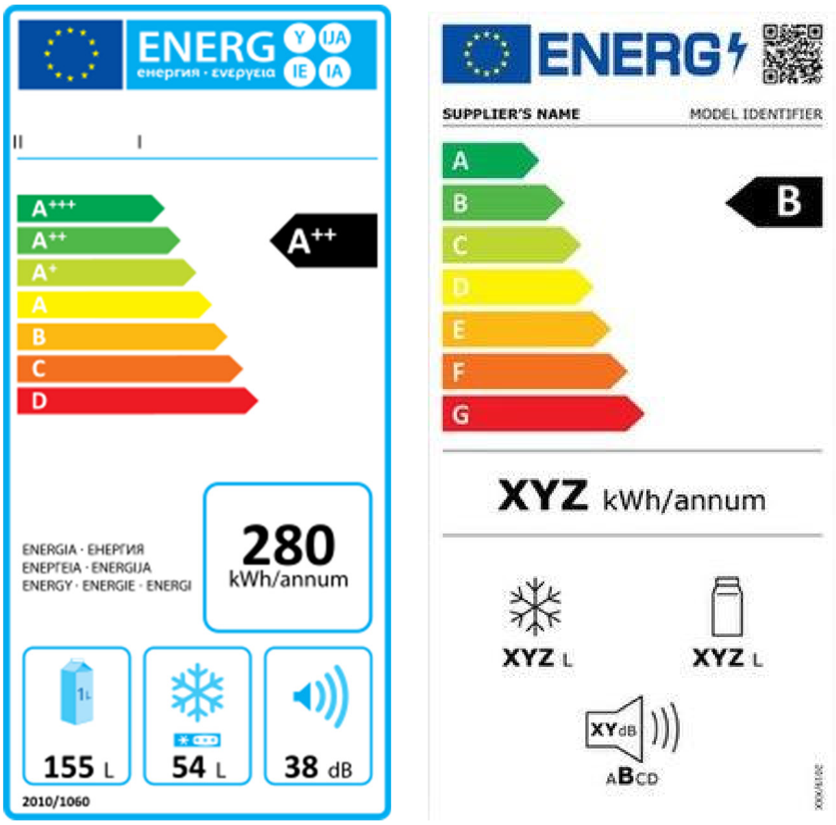


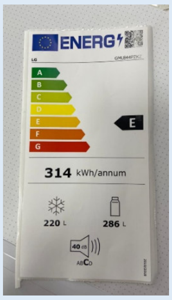
Figure 1: The old EU Energy Label (left), and the revised EU Energy Label (right)

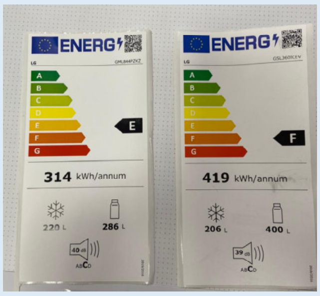
The defining rule of the new EU Energy Label framework is that "no products are expected to fall into energy class A at the moment of the introduction of the label and the estimated time within which a majority of models falls into that class is at least 10 years later". Finally, a very useful conclusion that came from the evaluation of the EU labeling program is that there is a need to maintain an up-to-date database containing information about all the products, and types of products, that are sold within a country's market. Such a database allows policymakers to adjust MEPS and other Energy Label related issues swiftly, while also minimizing any room for error.

In conclusion, the analysis of the EU labeling program offers three important points:

1. Energy efficiency labels and MEPS must be frequently revised and rescaled, so as to follow the evolution of the market and the progress of the respective technologies.
2. When creating Energy Labels, the use of the expanded 'plus scale' (A+, A++, A+++) should be avoided, as it is misleading and ineffective for the consumers. Instead, the A to G must be preferred.
3. An up-to-date database must be maintained, containing all products and models available in the market, so as to simplify policymaking.

To remember: During our market study carried out during the first field mission, we found these European labels in most of the stores visited. Below are some photographs of the labels displayed in stores.





3.2 Label in Brazil

Brazil has both energy efficiency laws and programs (action plans, combination of different energy measures), and has set as its target to reduce by 10% its overall electricity consumption by 2030. Regarding Energy Labels and MEPS, Brazil began exploring a labeling program for energy-consuming programs in 1984, making it one of the first countries in Latin America to implement MEPS. Despite the fact that the country has been at the fore-front of energy labeling, the use of Energy Labels is still voluntary.

Figure 2: Brazil - Energy Label

The Brazilian Labeling Program (PBE, for its initials in Portuguese) based its label on the European Union’s label using the A to G scale. Various studies conducted over the years have shown that energy labels in Brazil are beneficial for consumers, assisting them in their purchases. In addition to the PBE, Brazil also has the Selo PROCEL, which is an endorsement labeling program managed by PROCEL, a state-owned electricity generation and transmission program. This program currently covers 41 product categories, starting with refrigerators in 1995 and having most recently added LCD TVs and LED luminaires in 2017. Despite its financial struggles over the years, because of its declining budget, PROCEL is seeking to update and expand the Selo PROCEL, to further support the PBE. What the Selo PROCEL program lacks is up-to-date criteria regarding the categorization of products, which have not been meaningfully revised over the past decade. Same as the Selo PROCEL program, the PBE does not have a clearly defined system for determining when and how to revise labeling criteria. Finally, the Selo PROCEL program also involves an extensive database of products available in the Brazilian market, with specific information on their efficiency and capacity, but it does not monitor actual sales, containing many products that are not currently available in the market, resulting in an inability to evaluate the sales-weighted average efficiency in the market.

3.3 Labels in the ECOWAS Region

Regarding countries of the ECOWAS region, the process of implementing Energy Labels and MEPS started in 2011 and has been a long process. After debate, in November 2015 it was confirmed that the dial type energy label will be used - using the ‘star scale’.

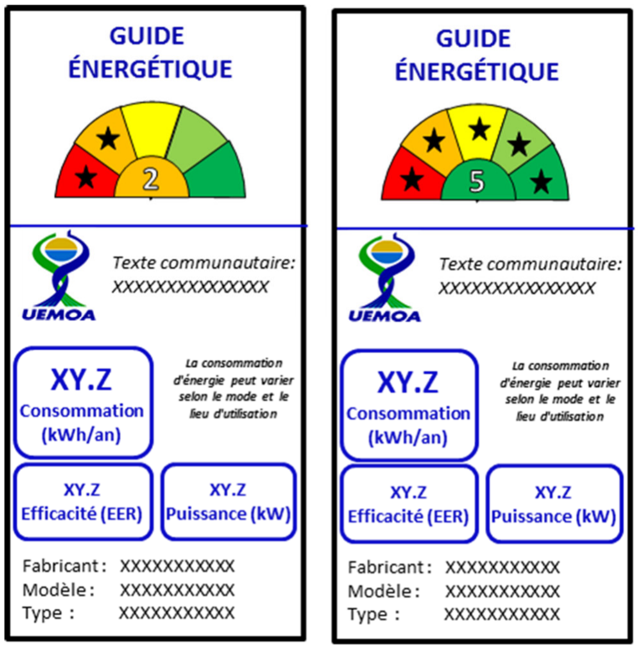


Figure 3: The general draft of the selected Energy Label

Based on this general draft, other countries of the ECOWAS region designed their respective energy labels.

3.3.1 Example in Nigeria

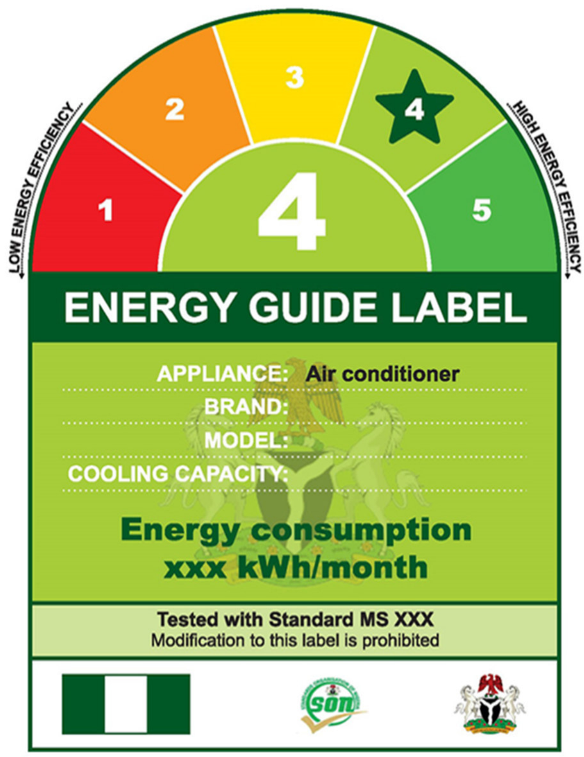


Figure 4: Nigeria Energy Label

3.3.2 Example in Ghana

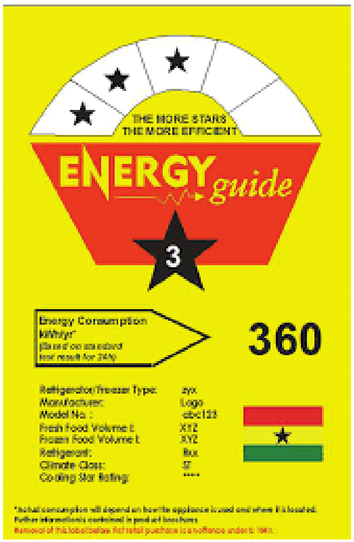


Figure 5: Ghana Energy Label

3.3.3 Example in Cabo Verde

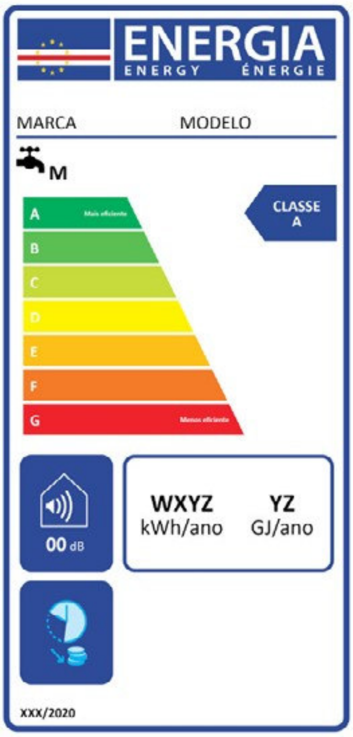


Figure 6: Cabo Verde Energy Label

3.4 Rest of the World

3.4.1 Example in South Africa

The new label, with the Department of Energy's energy efficiency logo on top, was developed in 2015 and was finally designed and revealed to the public in May 2016.

The new label has been phased-in giving both manufacturers and retailers enough time to use the updated South African Energy Efficiency Label. The old label is no longer acceptable for use in the market and manufacturers and retailers must ensure they are using the correct version.

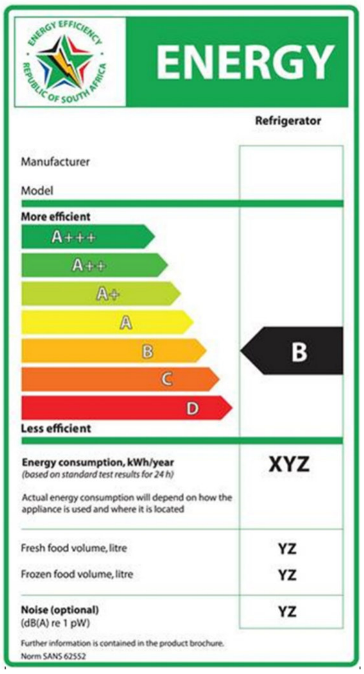


Figure 7: South Africa Energy Label

3.4.2 Example in India

The Indian Bureau of Energy Efficiency (BEE) launched the labeling program for fixed-speed ACs in 2006 as a voluntary initiative, and the program became mandatory in 2009. Since the inception of the AC labeling program, 46 TWh of electricity have been saved and 38 million tons of carbon emissions have been avoided.

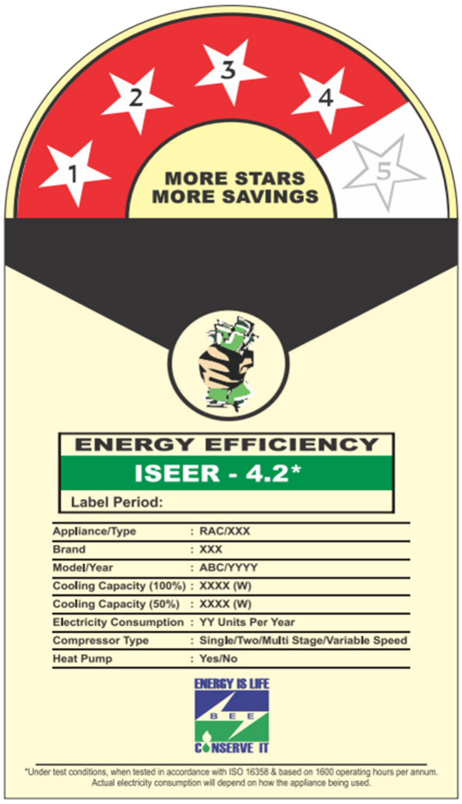


Figure 8: India eEnergy Label

BEE has been revising the star rating plans for windows and split ACs since the program was launched to increase the stringency of the energy performance thresholds based on analysis of the registered labeled products in BEE's database, with a view to ensuring that each star rating contains a meaningful share of the products available on the market. This distribution of products across all rating tiers allows consumers to clearly distinguish between the efficiency levels of the various available products.

It is also interesting to briefly analyze the Indian compliance framework. The compliance program begins with strict product registration: every product, in order to receive a label, must be fully registered and all the relevant documents must be submitted in the registration application. The registration process also involves laboratory testing by accredited labs. In the final step of the program, after labeling approval, every supplier must submit sales reports and pay a quarterly labeling fee to BEE. This system allows BEE to maintain a database of all AC models approved for sale on the Indian market, as well as their sales volumes, which facilitates policymaking by providing up-to-date information on the status of the market. Finally, BEE also conducts market surveillance, check testing and challenge testing to safeguard adherence to the compliance framework.

A notable aspect of the Indian labeling program is that the dramatic changes to the program, such as the implementation of the ISEER*, have first been introduced on a voluntary basis before being made mandatory. This transitional voluntary phase in making any large change has allowed manufacturers to adapt to policy changes over time and to understand how they can benefit from these programs before being required to participate.

*ISEER - Indian Seasonal Energy Efficiency Ratio

Starting on a voluntary basis in 2016, BEE adopted an improved rating methodology that factors in variance in temperature across the various climatic zones in India and operating hours. ISEER, the new metric for ACs is calculated as the ratio of the total annual amount of heat that the equipment may remove from the indoor air when operated for cooling in active mode to the total annual amount of energy consumed by the equipment during the same period.

3.4.3 Example in China

The China National Institute of Standardization (CNIS) has led an energy labeling program for more than 15 years. The China Energy Label has three to five levels, with level 1 being the most efficient and levels 3 or 5 being the MEPS, depending on the product.

Figure 9: China - Energy Label with 5 levels (left) and Energy Label with 3 levels (right)

The label levels are specified in the same document as the MEPS, and label rescaling occurs as part of the MEPS revision process. Chinese regulations require that each MEPS includes at least three label levels, with at least some products in each of the labeling categories. The label also now includes a QR code that allows customers to access additional information on the product's energy performance, although some retailers have been known to remove the QR codes, as they believe that it provides consumers with too much information and can be confusing.

In addition to the labeling program, China also implemented the Top Runner program at the end of 2014. This program is intended to identify and recognize the appliances, equipment, enterprises, and buildings with the best energy performance. Top Runner appliances receive a special Top Runner mark on the China Energy Label. But this program has not been sufficiently effective in shifting the household appliances market towards energy efficiency because the criteria for the Top Runner label are very strict and not directly related to the criteria for the China Energy Label. The result is that very few products have received the Top Runner designation and these products are very expensive.

In conclusion, the China labeling program shows us that energy labels that clearly differentiate highly efficient products can form the basis for effective market transformation programs, but also that very strict criteria for endorsement labels may result in few products receiving the designation, low consumer awareness, and lack of interest from certification bodies and product suppliers.

3.4.4 Example in the Southeast Asia

In 2015, members of the Association of Southeast Asian Nations (ASEAN) agreed to harmonize their standards for ACs to a single, seasonal metric. Two countries that have already made the shift to seasonal test metrics for their labeling programs are Vietnam and Thailand. The experiences of these two countries show that the test metric must be applied to all products in the same way in order to have maximum effect on the market:

Example in Vietnam

Energy performance labeling is mandatory in Vietnam. Vietnam's Ministry of Industry and Trade (MOIT) oversees the energy labeling program. The Vietnamese energy label is a comparative label that provides star ratings from 1-5. A certified energy label provides the following information: manufacturer's name, product origin, model number, rated power, energy efficiency, the relevant regulation, and certification number.

Figure 10: Vietnam - endorsement label (left) and Energy Label (right)

Example in Thailand

In Thailand the Energy Label is voluntary, implemented by the Electricity Generating Authority of Thailand (EGAT), with five levels. Because the label is voluntary, manufacturers only choose to label products achieving the fifth labeling level. The label is well-recognized by Thai consumers and the vast majority of AC units sold on the Thai market are labeled EGAT No. 5. Notably, government procurement often requires that products have the EGAT No. 5 label.

Figure 11: Thailand Energy Label

The label levels have been revised several times since the program was launched. Until 2015, all AC units had their efficiency measured by EER. However, in 2015, Thailand began the move to harmonize its labeling tiers to the ASEAN metric by introducing new label levels for inverter AC units, based on seasonal energy efficiency ratio (SEER).

3.5 Lessons learned from benchmarking

All identified Energy Labels in the ECOWAS region, implemented or in draft, have used the dial label with stars as their prototype, with the only exception being **Cabe Verde that used the bar A+++ - G label, same as other African countries outside the ECOWAS region**.

Based on the analysis of the energy labels used in the ECOWAS region we can highlight some key conclusions.

Firstly, **the dial star labels are the most popular** and various studies have shown that they are also **preferred by consumers**, especially the design that uses a different color for each star that allows for a better distinction of the energy classes - as has also been adopted by Nigeria, the largest economy in Africa.

In addition, the **most reasonable approach is the 5-stars scale**, although some countries opted for the 3-stars scale, and the energy labels have to cover at least the 3 official languages of the ECOWAS region.

Finally, the energy label must have the following characteristics: the energy efficiency class provided as a star, the ECOWAS logo and Label Implementing Regulation, the rated energy consumption, the name of the manufacturer, the model and type of appliance.

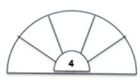
Questions		Percent		Percent
What should be used to display Energy Class on the dial	Star ★	100%	Number 4	0%
Black or White	5 ★	82%	5 ☆	18%
If a number is applied: show only the numer or the number with a star?	★4	56%	4	44%
For a star label: shall the stars below the allocated energy class be empty or with the same colour?	☆ ☆ ☆ ★ ☆	17%	★ ★ ★ ★ ☆	83%
For a star label: shall the cells above the applicable energy class show the contour of a star or not?	★ ★ ★ ★	55%	★ ★ ★ ★ ☆	45%
Middle of the dial	With a cell showing the number of the class 	92%	Without a cell 	8%
Middle of the dial	With the colour of the applicable energy class	83%	Without the colour of the applicable energy class	17%
Guidance sentence	Below the dial	83%	Left and right	17%
QR Code	Yes	100%	No	0%

Figure 12: Survey results for the use of Energy Labels in the ECOWAS region

In Central Africa, the ECCAS together with UNIDO recently approved the creation of the Center for Renewable Energy and Energy Efficiency for Central Africa (CEREEAC). Once fully operational, the CEREEAC will reduce market barriers by promoting economies of scale, joint coordination, learning, tools and methodologies. It will become a hub for international partnerships and a window for innovation and technology transfer to the region. Nevertheless, there is yet to be developed a regional label, as in the ECOWAS region.

In addition, during market research in São Tomé, we found that:

- The energy labels displayed in stores are based on European models,
- All imported products come from Portugal/China.

The European label has been developed through extended studies and research, and has proved to be very useful for consumers. As part of the European Union, Portugal is also using the EU label. This means that appliances imported from Portugal have already received the EU label through testing, that labels are tested and all necessary information of an appliance can easily be provided through documentation.

4 DESIGN OF INFORMATIVE LABELS FOR APPLIANCES

The primary decision will be whether the labels will be Bar type (like EU, Brazil, South Africa, etc.) or Gauge type (like Ghana, Nigeria, Kenya). A graphic design will be chosen and followed, based on existing labels. The information on the label will be based on the information provided in the previous phases.

The next issue to be agreed upon is the contents of each label. For lighting equipment, the primary factor is light output (lumen) per electricity consumed. AC and refrigerator labels besides EE class, will also have to contain more information like capacity, working fluid, noise, etc.

Label layout will be designed to contain information on the product, administration organization, etc.

4.1 Breaking down the EU Label

For lighting equipment, the label is shown below. The information included are supplier's name, the model of the lighting source, its energy efficiency class, the energy consumption per 1000 hours and a QR code which can provide more information on the product.

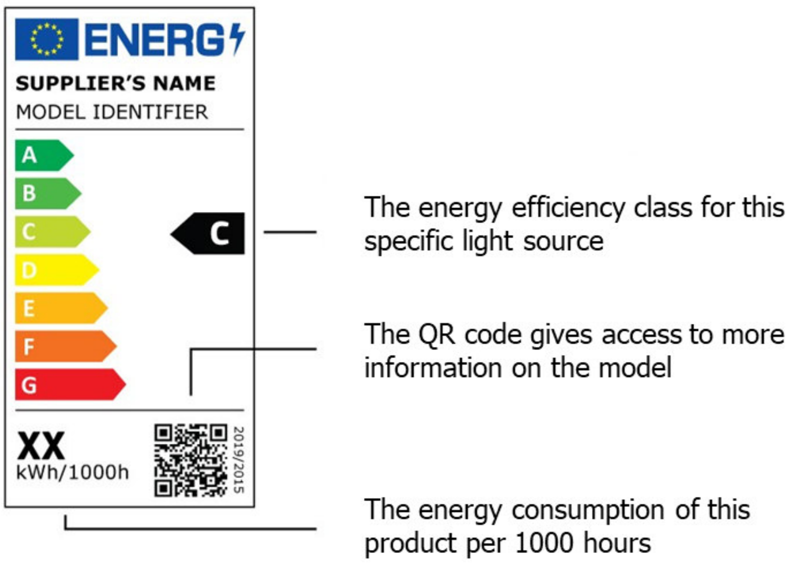


Figure 13: Breakdown of EU lighting label

For refrigerators, the information that are the same as in the lighting label are the supplier, the model of the product, its energy class and the QR code which can provide further information. Information that are included that refer to refrigerators are their storage capacity for chill and frozen compartments, the noise level (which ranges among 4 categories, that differ to the energy class), and the annual consumption.

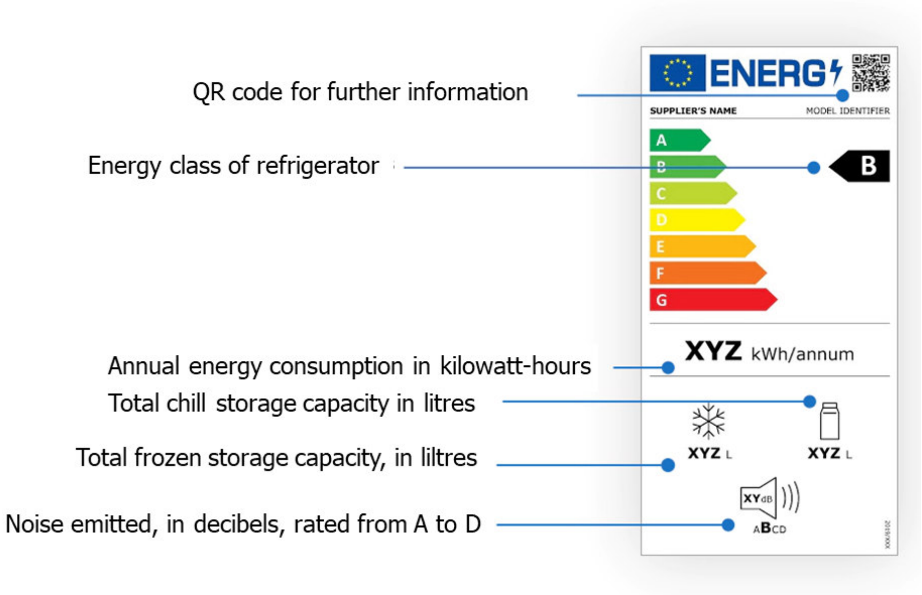


Figure 14: Breakdown of EU refrigerator label

Finally, the label for A/C appliances, besides the common information (brand, model, energy class, QR code) includes the following information:

I. Supplier's name
II. Model's name
III. SEER factor indicates cooling function only, and is followed by the fan and air wave icon.
IV. Energy efficiency class
V. Design load
VI. Seasonal Energy Efficiency Ratio (SEER) value
VII. Annual energy consumption in kWh per year
VIII. Sound power level for indoor unit in dB
IX. Sound power level for outdoor unit in dB

The above information is indicated on the label displayed below.

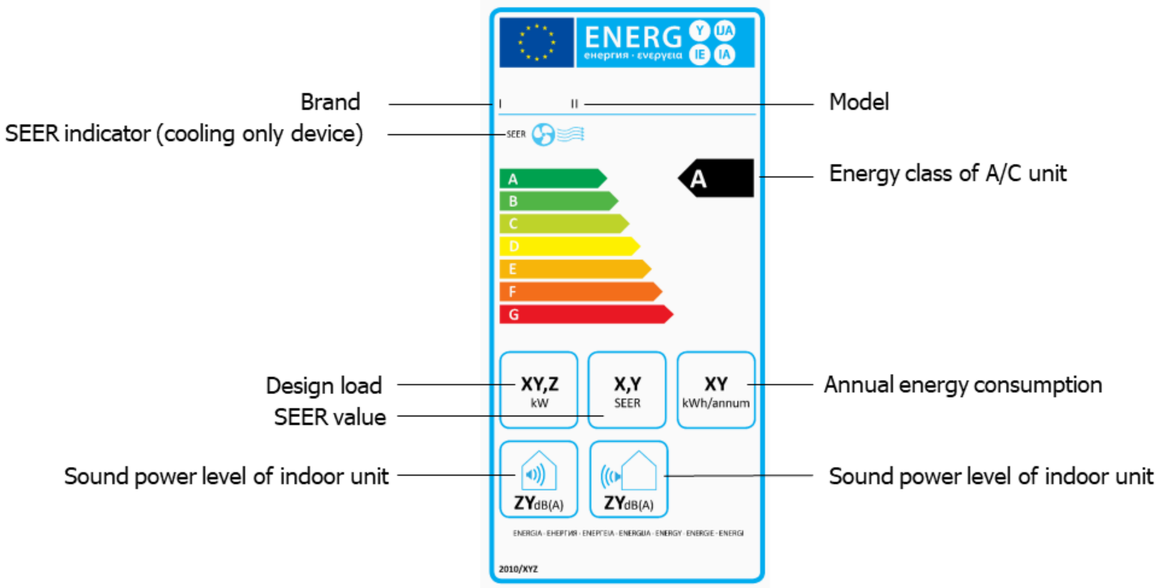


Figure 15: Breakdown of EU A/C label

Cape Verde has also adopted the bar type energy label. The labels for the three types of appliances (lighting, refrigerators, A/C) are shown below. The energy classes remain in the A+++ / A++ / A+ / A / B / C / D scale, which in the new European energy label have been replaced with the A-B-C-D-E-F-G scale.

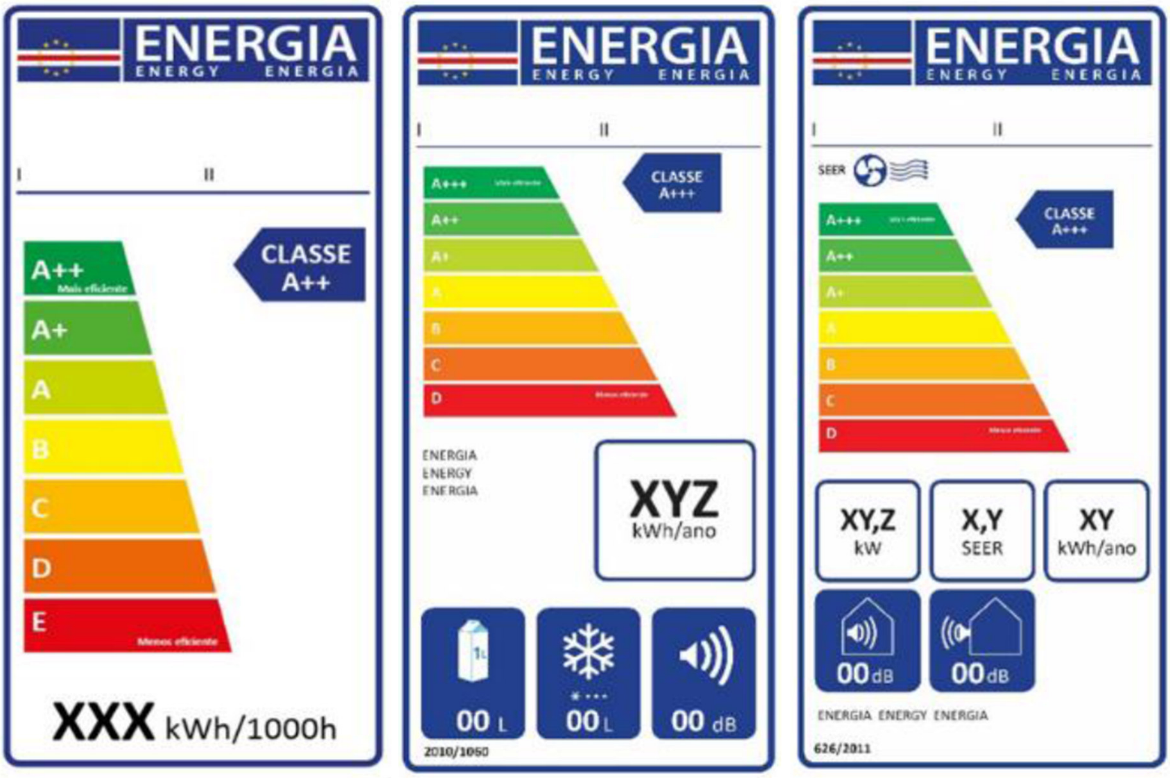


Figure 16: Cabo Verde - labels for lighting, refrigerator, A/C

The information provided on those labels are the same as in the respective EU labels. In terms of design, Cabo Verde has used its flag on the upper left, instead of the EU flag, and has added the colour blue for the frame of the label, the energy class of the device and the icons that are used to indicate information (refrigerator capacity, noise level, etc.). Finally, we can see that the QR code is absent, since Cabo Verde has not developed a system to provide more information like EU does.

4.2 The results of the validation workshops

The consultant supported UNIDO to organize the workshops for validation and harmonization of MEPS and labels (while also participating in the aforementioned workshops).

Two validation (2) workshops were organized and the report was created and shared with UNIDO along with this document. The workshops covered the MEPS and labeling schemes jointly. The used raw data and spreadsheets will be provided to UNIDO and MOPIRNA.

During the first workshop, the consultant presented the elements of the current phase. The mechanism for MEPS and labels was explained, along with information on testing procedures and the plan for implementing and comply to the above. The consultant’s recommendations were also shared with the group, and after the presentation the participants were asked to share their questions with the consultants.

During the second workshop, the participants were divided into working groups, and were asked to fill out a questionnaire for the purpose of validating the consultant's proposal, and voice their opinions on the matter.

On the matter of labels, all of the groups agree that the bar-type label should be adopted, for the reasons that they are already circulating in STP and therefore are easier to understand. Another reason for this choice was its popularity, and that it suits the reality of the STP market.

- Group 1 & 2: Both groups opted for the bar type label because it is a label that is easy to understand visually. Also, as the equipment imported to STP comes from Europe, most of the equipment already has these labels.
- Group 3: STP must rely on the European model because in our opinion it is an easier to understand and more familiar label
- Group 4: The group chose the European model because it is the most used today.
- Group 5: The group opted for the EU model with regard to the structure of STP's trade.

On the matter of testing procedures, all groups agreed that both methods for testing (documentation check & lab testing) are deemed important for controlling imported appliances and whether they are acceptable for STP.

For the implementation plan several groups had comments or activities to add:

- Group 1: Proposed additional elements to Component 1:
    - Activity 1.3: EMAE can support the implementation of this activity.
    - Activity 1.6: Customs department can be relied on for this activity.
    - Activity 1.9: The customs department must also be involved in this activity because it works on the implementation of taxes, to curb the introduction of inefficient products.

- Group 3: Proposed an additional activity for component 1, which involves training, public awareness, managed by MIRN and supported by SENAPIQ-STP and AGER.
- Group 4: Proposed several additional elements
    - Component 1: DGA to be involved in activity 1.9
    - Component 1: Additional activity for taking measures to support consumers and the dissemination of new regulations by the media
    - Component 3: Proposed Department of Trade and the National Institute of Statistics to be involved in activity 3.6
- Group 5: The group proposed more associations to be involved in the procedures, and especially stakeholders that will be asked to provide documentation for their products

4.3 Label proposed for STP

STP will have an awesome label.

For the design of the STP label, the elements to focus on are the following:

- Flag of the country
- Font & color of text
- Color of frame
- Color of informative indicators
- Classification & design of energy class bars

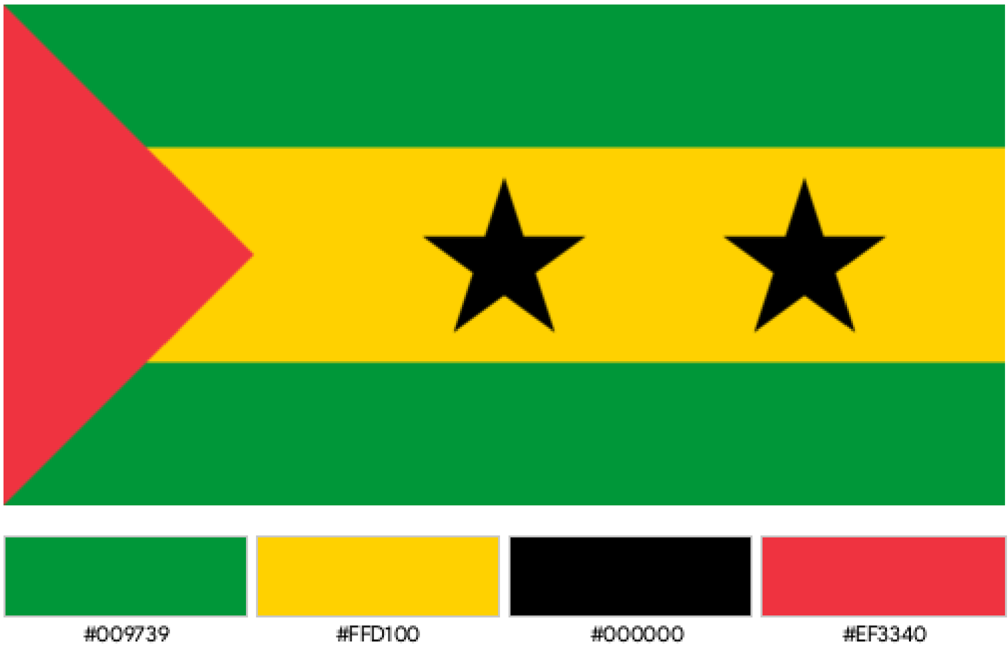


Figure 17: STP flag colors

The STP flag will be place on the upper left, as in the other bar-type labels. Between the colors of the flag, green covers most of the STP flag and is also the easiest on the eye. Therefore, the frame of the label can be green.

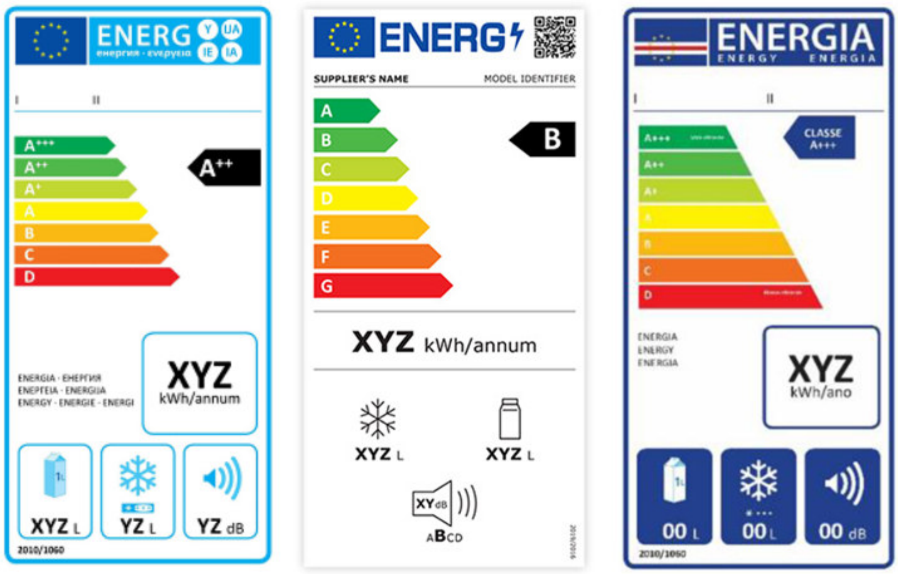


Figure 18: Examples of bar-type labels

The font used for the text on the label needs to be clear and consistent. It is important to format the label right, so that there are no error on the text when printing the labels.

The icons that provide information on the device can be colored (old EU label), black (new EU label) or have a colored frame (Cabo Verde label). If STP chooses to use a color for the icon or its frame, like Cabo Verde did, it might make the label more confusing, since the colors of STP and the colors of the energy classes are very close. When designing an energy label, it is important to choose colors carefully, as different colors can indicate different types of information. For STP, the icons design of the new EU energy label, which is a clear and minimal design and simplifies the label, is optimum.

The energy class of the device, which is displayed on the right of the energy class bars, needs to be clear with a quick glance that it is referring to the device. That is why it needs to have a font bigger than the font in the bars, and a different color. Cabo Verde chose the color blue instead of black, due the color in its flag. STP can choose the black color, like EU, since it is also the color of the star in the STP flag. It is important to note the difference between the 3 labels displayed above. In the new EU label (middle) the energy class of the device is much easier to spot than in the other labels.

Although some definitions of the new EU energy label say that there should be, in the future, a maximum of 7 classes per label, currently some labels have 10. In theory if the top class in a label is A++ then the bottom class in the same label must be E, while the best class must be green and the worst class must be red.

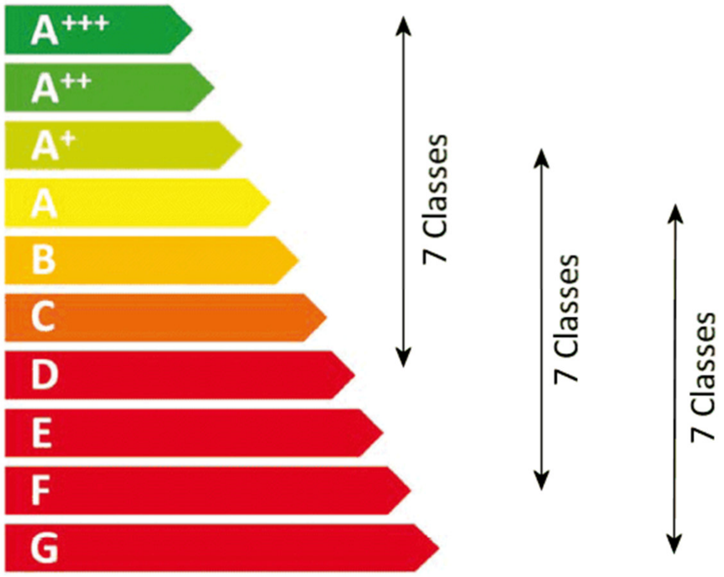


Figure 19: Energy classes A+++ to G

Whether STP chooses to have the new format of energy classes (A to G) or keep the old format (A+++ to D) depends on whether adding more than 7 classes to the label is deemed important. This is an element that is closely linked with the reality of the STP market. Currently, STP mainly imports from Portugal. Since Portugal is a part of the EU, every appliance exported to STP has to conform with European standards and procedures. That means that appliances imported to Portugal already have the EU label on them, which means that if STP adopts the same labels as the EU, checking which equipment is allowed in STP becomes a very easy process.

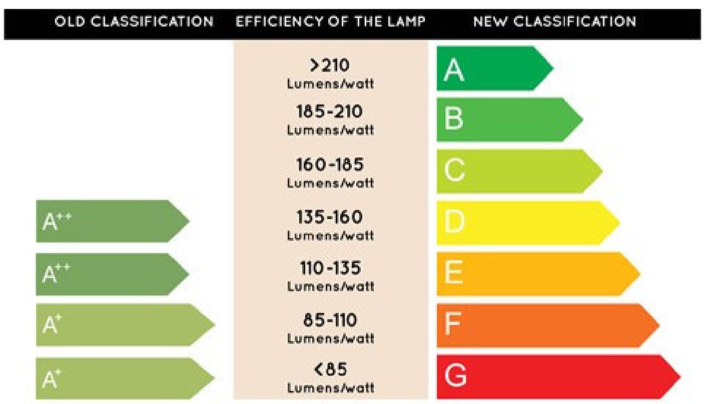


Figure 20: Rescaled energy classes for lighting

The old model (A+++ to D) is starting to be phased out in the EU, as it became confusing for the consumers. In addition, the new labels are being carefully designed so that new technologies can be distributed evenly between the energy classes.

For STP, we suggest that the latest energy classes model (A to G) are adopted. EU has currently introduced the new label for lighting and refrigerators. For A/Cs, STP can adopt the old labelling scheme (A+++ to D), and change to the new label (A to G) once EU has introduced it.

5 SELECTION OF TESTING PROCEDURES

The objective of a product test method can be set out in general terms using some standard goals as stated by the IEC. Ideally a test procedure should be:

- Repeatable (same result on the same product in the same lab on retest): this is a combination of the test consistency and the product behaviour or consistency;
- Reproducible (same result on the same product in different labs): repeatability plus interlaboratory differences;
- Technically simple but able to cope with new and emerging technologies;
- Inexpensive, avoiding the need for very expensive specialized equipment where possible;
- Quick as practicable;
- Reflective of consumer use and consumer relevant.

An introduction to testing procedures for lighting, refrigerator and air-conditioning appliances, which is based on international experience, is presented in this chapter.

5.1 Testing procedures for refrigerators

In general, an air-conditioning testing facility needs to cover the following in order to comply with international standards:

- **Civil works – Construction of the facility:** The testing room will be built by insulating existing floors, ceilings and walls internally and building new walls from insulating material. The floor needs to be elevated as to allow passage of ducts for electrical, monitoring and hydraulic networks. The internal volumes of the refrigerator testing room need to be defined in order to schedule construction and calculate materials.

- **Refrigerator testing cabinet:** A testing platform allowing the installation of the UUT (Unit Under Test) and equipped with the necessary sensors is constructed and installed for refrigerator tests. This testing structure is placed inside the Refrigerator testing room. The construction of the platform should follow the below requirements:
    - A wooden solid-top horizontal platform
    - One wooden rear vertical partition
    - Two side wooden vertical partitions
    - reduced capital cost.

- **Data logging system:** The data logging system should measure and record all the necessary parameters to determine the Energy Efficiency Ratio of the machines to be tested. It should be a unique system to record:
    - Operating parameters such as temperatures, humidity, pressure, etc;
    - Energy measurements.

  In general, the data logging system should be “open”, i.e. programmable for inputs of 0-10V, 4-20 mA, etc. and not binding the owner with specific sensors. It should also allow for Modbus other protocol inputs so energy meters parameters can be readily incorporated.

  For Refrigerator, measurements to be taken include:

    - Temperature on the sides, in front, below and above the UUT;
    - Temperature inside the UUT (M-packages equipped with thermocouple);
    - Temperature stratification in the room (3 different measuring points);
    - Relative humidity at a representative point in the room;
    - Energy consumption of the UUT.

- **Electrical work:** Electrical works consists on the supply, the installation and connection of the below described elements. Electrical works include:
  - Supply, installation and wiring of lighting fixtures and outlets in the testing rooms;
  - Design, construction and installation of the electricity and control boards and supply all elements inside;
  - Supply, installation and wiring of a voltage stabilizer;
  - Wiring/connection of the fan coil unit, UUT;
  - Wiring and connection of the data logger and all sensors;
  - Electricity supply to data logger and computer.

  All electricity works and wiring have to be performed based on country standards. All electricity and sensor wires of the electrical networks will have to be placed for protection inside plastic or metal tubes, channels or metal trays.

  Placement of lights, outlets and wiring in general must not weaken the insulation of the insulated shells. All passages between testing chambers and/or outside should be done through the foreseen ducts passing below the insulated floor (i.e. inside the raised floor) and should not weaken its thermal insulation. Extra ducts and/or extra space inside the ducts reserved for electricity & power supply should be provided in order to ensure the evolutivity of the testing rooms. Those ducts should be properly sealed in order to avoid air communication between testing rooms and/or outside.

- **Hydraulic work:** Hydraulic networks will have to be constructed to:
  - Connect the fan coil unit of the refrigerator testing room to the chilled water network;
  - Provide refill water from the water supply of the building to the chilled water system and to the humidifier;
  - Allow the installation of sensors where it is necessary;

  Piping of the conditioning units and the UUT should be made according to manufacturer's instructions and specifications. All pipes, tanks, pumps, filters and connection parts, bends, insulation will be supplied by the contractor of hydraulic works.

  All passages between testing chambers and/or outside should be done through the foreseen ducts passing below the insulated floor (i.e. inside the raised floor) and should not weaken its thermal insulation. Extra ducts and/or extra space inside the ducts reserved for the hydraulic network should be provided in order to ensure the evolutivity of the testing rooms. Those ducts should be properly sealed in order to avoid air communication between testing rooms and/or outside.

- **Training of staff:** Training should be schedules in order to cover at least the following topics:
  - The control of the chilled water system;
  - The control of the air conditions inside the refrigerator testing rooms (control of the AHUs and fan coil unit);
  - The sensors connection and handling;
  - Data logger configuration and use.

5.1.1 Analysis of existing procedures at the international level

Capabilities to assess equipment performance levels are very important to the standards and labeling program envisioned at STP.

The energy performance level of a device is determined following a series of device tests, carried out to determine their parameters.

These tests must conform to a standardized test procedure.

Here are the main test procedures used in some countries as well as the recommended test procedure for refrigerators under this program. Internationally, four test procedures are used to test refrigerators.

They are based on the following standards:

- Japanese standard JIS C 9801,
- Australian standard AS/NZS4474
- American standard ANSI/AHAM HRF-1-2004
- The international standard ISO/IEC 15052:2005 adopted by the EU.

There is a number of factors that affect the energy consumption of a refrigerator. The most important of these are:

- Ambient temperature;
- Processing load from the addition of warm air and humidity through door openings and processing load from the addition of food and drink to be cooled (effectively, the efficiency of the refrigeration system);
- Internal compartment temperatures (user settings);
- Design and energy associated with the defrost and recovery (for defrost free products);
- Impact of additional internal humidity in terms of the response of the defrost system (including frequency of automatic defrost cycles) to remove this moisture;
- Additional user related features such as ice and water dispensers, additional doors, multiple compartments and special use zones;
- Possible longer term deterioration in energy performance with age (wear and tear, failure of components).

Figure 21: Overview of test procedures used for performance testing of refrigerators (source: ECOLONER)

Test Parameter	ISO/IEC 15052:2005	ANSI/AHAM HRF-1-2004	AS/NZS4474	JIS C 9801
Ambient Temperature	35 ± 0,5 °C (tropical climate) and 25 ± 0,5 °C (Other climates)	32,3 °C	32 °C	15 °C and 30 °C
Relative Humidity	75% max	Non precise	Non precise	75 ± 5 °C for 30°C and 55 ± 5 °C for 15°C
Fresh food compartment temperature	5 °C	3 °C for all refrigerators and less than 7,22 °C for all refrigerators and freezers	3 °C	4 °C
Freezer compartment temperature	-18 °C	-15 °C	-15 °C	-18 °C
Loading	Freezer loads (touching the walls)	75% loading for icing types	None	For non-icing types, load all compartments
Door opening	None	None	None	Natural convection varying according to the type of defrost
Volume measurement methodology	Storage volume using ISO methodology	Storage volume using ANSI/ASHAM methodology	Gross volume using ISO methodology	Storage volume using ISO methodology

Testing procedures vary according to three criteria:

- the ambient temperatures of the calorimetric chamber to which an appliance is exposed,
- the ambient temperatures of the different compartments,
- the percentage of relative humidity to which an appliance is exposed.

5.1.2 Recommended testing standards for STP

The international standard ISO 15502/EN62552 is the standard used in WAEMU countries because it takes into account the type of climate in the area. This standard has been adopted by many countries, in particular the member countries of the European Union.

This standard recommends testing equipment on the basis of the following characteristics:

- nominal gross volume
- nominal useful volumes
- indoor storage temperature
- freezing power
- daily energy consumption
- adjusted storage temperature
- temperature rise time
- acoustic emission in the air

These measurements are taken in a test chamber inside which the temperature and relative humidity are controlled. The temperature in various places in the refrigerator is measured with a multi-channel thermometer, and the consumption is measured using a digital power meter. The minimum duration of a test is three days.

5.2 Testing procedures for lighting

A lighting testing laboratory uses various elements for light measurements:

- **Integrating Sphere:** It allows measure the colour temperature and luminous flux of luminaires with extreme accuracy. The instrument consists of a sphere with a diffusing internal surface, at the center of which the luminaire under test is suspended.
- **Anechoic chamber:** Before being placed on the market, any electrical device must be tested to verify that it cannot cause damage to the health of the user, that it does not cause interference with other devices in the vicinity and that it does not suffer from disturbances that these same devices spread. The electromagnetic compatibility tests (also called EMC tests) are performed in an anechoic chamber with the aim of ensuring that the luminaires continue to function correctly without interference between them and without being influenced by external frequencies. In fact, the anechoic chamber serves to recreate, in a closed environment, simulated conditions of open space of infinite size, given the absence of reflections of its fully shielded walls.
- **EMC Chamber:** Verification test for electromagnetic compatibility
- **Goniophotometer:** Allows measurement of the flux emitted by the luminaire and detection of the photometric distribution of the emission. Goniophotometers are installed inside dark rooms covered with materials that limit the stray light within the allowed limits. The darkroom is equipped with air conditioning to keep the temperature, humidity and speed of the ambient air within the regulatory limits, fundamental factors for the measurement of LEDs.
- **Thermal Chamber:** The functionality of a luminaire must be guaranteed in all required environmental operating conditions. The luminaire is turned on and brought to a thermal regime at the expected ambient temperature. The instruments used for correct operation of a thermal chamber are the controlled temperature oven, the climatic chamber, the temperature data logger and the digital multimeter.

There are more tests that can be applied to lighting fixtures, like a vibrating test, which allows testing the mechanical resistance of a lighting fixture, or an immunity test for electromagnetic disturbances.

The neccessary equipment for a lighting testing laboratory depends on the standard that the fixtures will be tested to.

5.2.1 Analysis of existing procedures at the international level

EN13032-1+A1 is the European standard, which establishes general principles for the measurement of basic photometric data for lighting application purposes. It establishes the measurement criteria needed for the standardization of basic photometric data and details of the CEN file format for electronic data transfer. In addition to it being a valuable standard in its own right, this standard has been written in two parts to provide the basis of photometric measurement in part 1 and verification and presentation techniques for specific lighting applications in part 2.

For the USA standards, it is important to distinguish between relative and absolute photometry:

- Relative photometry is based on splitting out the measurement of a light source (or “lamp”) in isolation and then a measurement of the whole luminaire output. From this, the light output ratio (LOR), or optical efficiency of the luminaire is calculated.

- Absolute photometry is a technique that simply measures a complete luminaire to provide results for that exact configuration. It provides the specific lumen output of a specific luminaire as measured each time by the goniophotometer. Lumen output relates only to the luminaire being tested.

IES LM-79-08 requires the absolute method as the standard testing methodology, whilst IES LM-80-08 and IES LM-82-12 both use the relative method. IES TM-21-11 also takes the relative format data from LM-80 and extrapolates it to calculate luminaire life. Luminaires should be photometrically tested to LM-79, but other standards require alternate testing.

5.2.2 Recommended testing standards for STP

The European standard EN13032-1+A1 is a standard that has been extensively used and is mandatory for most European countries, including Portugal. The standard’s credibility has been tested through application, is very descriptive and covers a wide spectrum of information regarding lighting testing.

For a photometric test according to this standard, a goniophotometer is needed. There are many different types of goniophotometers available, however, during the tests, electrical and environmental parameters must be constantly monitored to ensure a correct stabilization of the sample under test and to provide the most reliable results possible.

Photometric tests should provide the measurement of quantity, colour, quality and spatial distribution of light emitted by lamps, and lights. Photometric tests can also provide other data of interest such as luminous flux, electrical consumption, colour temperature and colour rendering index, among others.

5.3 Testing procedures for air conditioners

In general, an air-conditioning testing facility needs to cover the following in order to comply with international standards:

- **Civil works – Construction of the facility:** testing chambers will be built by insulating existing floors, ceilings and walls internally and/or building walls from insulating material. The floor needs to be elevated as to allow passage of ducts for electrical, monitoring and hydraulic networks. The internal volumes of the two chambers need to be specified in order to schedule construction and calculate materials.

- **Air conditioning for air conditioner testing chambers:** An AC testing facility is connected to an air reconditioning system. A chilled water system provides the cooling medium (e.g. water) to the cooling coil of the Air Handling Unit(s) of the AC testing chambers. Several factors must be taken into account:
    - accurate control of temperature and humidity;
    - need to determine the heat (cooling) input to the AC testing chambers;
    - reduced capital cost.

- **Data logging system:** The data logging system should measure and record all the necessary parameters to determine the Energy Efficiency Ratio (EER and SEER for AC tests) of the machines to be tested. It should be a unique system to record:
    - Operating parameters such as temperatures, humidity, pressure, etc;
    - Energy measurements.

  The European standard for AC testing mandates that all measurements must be recorded at regular intervals.

  In general, the data logging system should be "open", i.e. programmable for inputs of 0-10V, 4-20 mA, etc. and not binding the owner with specific sensors. It should also allow for Modbus other protocol inputs so energy meters parameters can be readily incorporated.

  For AC, measurements should be taken and data logged for:

    - Temperatures (Dry-Bulb and Wet-Bulb) around the UUT (Unit Under Test);
    - Temperatures & flows through pipes (integrated they give thermal energy supplied or removed);
    - Electric power in W and energy in Wh supplied to UUT and the elements of the AHUs;
    - Water supplied or removed to control RH (WB temperature).

- **Electrical work:** Electrical works consists on the supply, the installation and connection of the below described elements. Electrical works include:
    - Supply, installation and wiring of lighting fixtures and outlets in the testing rooms;
    - Design, construction and installation of the electricity and control boards and supply all elements inside;
    - Supply, installation and wiring of a voltage stabilizer;
    - Wiring/connection of the chiller system, AHUs, UUT;
    - Wiring and connection of the data logger and all sensors;
    - Electricity supply to data logger and computer.

  All electricity works and wiring have to be performed based on country standards. All electricity and sensor wires of the electrical networks will have to be placed for protection inside plastic or metal tubes, channels or metal trays.

  Placement of lights, outlets and wiring in general must not weaken the insulation of the insulated shells. All passages between testing chambers and/or outside should be done through the foreseen ducts passing below the insulated floor (i.e. inside the raised floor) and should not weaken its thermal insulation. Extra ducts and/or extra space inside the ducts reserved for electricity & power supply should be provided in order to ensure the evolutivity of the testing rooms. Those ducts should be properly sealed in order to avoid air communication between testing rooms and/or outside.

- **Hydraulic work:** Hydraulic networks will have to be constructed to:
    - Connect all parts of reconditioning system (chiller(s), circulation pump(s), expansion tank(s) and AHUs);
    - Connect inner and outer cooling heat exchangers of the UUT (AC testing chambers);
    - Provide refill water from the water supply of the building to the chilled water system and to the humidifier;
    - Drain condensates of the UUT (AC) and AHU heat exchanger;
    - Allow the installation of sensors where it is necessary;

Piping of the conditioning units and the UUT should be made according to manufacturer's instructions and specifications. All pipes, tanks, pumps, filters and connection parts, bends, insulation will be supplied by the contractor of hydraulic works.

All passages between testing chambers and/or outside should be done through the foreseen ducts passing below the insulated floor (i.e. inside the raised floor) and should not weaken its thermal insulation. Extra ducts and/or extra space inside the ducts reserved for the hydraulic network should be provided in order to ensure the evolutivity of the testing rooms. Those ducts should be properly sealed in order to avoid air communication between testing rooms and/or outside.

- **Training of staff:** Training should be schedules in order to cover at least the following topics:
    - The control of the chilled water system;
    - The control of the air conditions inside the AC testing rooms (control of the AHUs and fan coil unit);
    - The sensors connexion and handling;
    - Data logger configuration and use.

5.3.1 Analysis of existing procedures at the international level

Testing facilities that follow the European Standards are in conformity with **EN 14511**. This European Standard specifies minimum operating requirements which ensure that air conditioners, heat pumps and liquid chilling packages using either air, water or brine as heat transfer media, with electrical driven compressors are fit for the use designated by the manufacturer when used for space heating and/or cooling. The standard covers an extensive range of data among the following:

- Terms & definitions
- Test conditions
- Test methods
- Requirements

Another European standard is the EN 814 and the EN 255. EN 814 specifies minimum requirements which ensure that an air or water cooled air conditioner, air/air or water/air heat pump, with electrically driven compressor, is fitted for the use designated by the manufacturer, when used in cooling mode. When these units are used in heating mode by reversing the refrigerating cycle, then EN 255 applies. This standard also specifies recommendations for the way the characteristics of units shall be specified by the manufacturer in order to assist users and manufacturers in the understanding and comparison of various types.

Other standards on the scope of air-conditioner's energy efficiency testing are

- **ASHRAE 16**
  Methods of Testing for rating room air conditioners
- **AHAM RAC-1**
  AHAM Standard for room air conditioners
- **ASHRAE 41.1**
  Standard Method for Temperature Measurement
- **ASHRAE 41.2**
  Standard Method for Laboratory Airflow Measurement
- **ASHRAE 41.3**
  Methods for pressure measurement
- **ASHRAE 41.6**
  Standard Method for Measurement of Moist Air Properties
- **ASHRAE 58**
  Method of testing for rating room air conditioner and packaged terminal air conditioner heating capacity
- **ISO 5151:2010(E)** & **BS ISO 5151:2010**

5.3.2 Recommended testing standards for STP

The European standard EN 14511 is a standard that has been extensively used and is mandatory for most European countries, including Portugal. The standard's credibility has been tested through application, is very descriptive and covers a wide spectrum of information regarding air-conditioner testing.

5.4 General recommendations

Currently, there are no appliance testing laboratories in STP. However, there are very few existing laboratories in other areas such as health, agriculture and the environment.

The market study phase shows that there is no laboratory in STP with the required capacities to house the tests to be carried out on the appliances within the framework of this project.

Also, the manufacture, the establishment of a laboratory supposes to have an organizational and legislative framework and sufficient resources. By way of illustration, these are:

- To have sufficient experience in verifying the conformity of imported or sold products, relying on functional laboratories in other areas
- To have human resources: technical experts, managers, support staff
- Financial resources
- Materials: vehicles, office automation, storage space, building to set up the laboratory.

These conditions are not sufficient: the laboratory must have international accreditation.

Currently STP does not have an organizational and legislative framework for setting up a test laboratory.

The cost of the testing facilities, for construction and continuous operation, may be very high for the local market of STP. For example, a testing facility for refrigerator could cost $300,000 initially, with an annual operation cost of $100,000. Given the small quantity of imported equipment, it does not seem appropriate to invest as much, whether in terms of human or financial resources, for the establishment and implementation of laboratories.

Testing facility by appliance type	Estimated cost of construction
Lighting	$100,000
Refrigerator	$1,000,000
Air Conditioning	$300,000

To conclude, the establishment and implementation of a test laboratory in STP is not recommended. We propose an alternative:

- ***Short term***

For the short term, the most practical testing procedure is through documentation check. As mentioned before, STP imports most of its appliances from Portugal. As a member of the EU, Portugal is obligated to follow EU protocol, which means that appliances imported from Portugal have been already tested in accredited laboratories to receive the European energy label. This means that imported appliances can arrive in STP with all the necessary documentation. That way, Customs can use the regulatory framework of the country in order to determine whether an appliance is eligible for importation or not.

Meanwhile, for appliances that are imported from non-EU countries, STP can seek cooperation with neighboring countries that have operational testing facilities.

It is noted that several laboratories in countries are close to STP, such as Ghana. To verify compliance to MEPS, Ghana has a test facility installed at the Ghana Standards Authority. The test method is based on national standards. The standard, which concerns lighting systems and fluorescent lamps is GS 323: 2003 "Lighting Systems - Self-Ballasted Lamps for General Lighting Services - Performance Requirements".

To further protect consumers against counterfeit, sub-standard and unreliable CFLs, the Energy Foundation, Energy Commission and Ghana Standard Board, have introduced a Performance and Efficiency Standard for CFLs47. The official regulation (L.I 1815) applies to self-ballasted CFLs and was enforced beginning in 2005.Ghana, through the customs department and the Ghana Standard Authority, also control entry points so that unauthorized products are not sold in the country.

On 19th November 2021, the Ghana Standard Authority (GSA) was formally handed the new Air Conditioner and Refrigerator Test Laboratory, which was internationally supported. The facilities cost close to 2 million dollars, and have the capacity to test 96 A/Cs and 48 refrigeration appliances per year. Ghana encourages neighboring countries to use its new laboratories for their testing needs.

Nigeria is also a frontrunner on energy efficiency testing, with programs for accredited laboratories for lighting, air-conditioning and refrigerating appliances.

Cape Verde has also developed laboratories for testing refrigerators and air-conditioners. As two lusophone countries, STP can seek help from Cape Verde and establish communication on the matter of testing appliances that are not imported from EU.

- **Long term**

Carry out **a feasibility study** for a possible physical control of the equipment with 2 options:

1/ Establish a partnership with other existing laboratories

2/ Study the possibility of setting up a laboratory in STP

This feasibility study must contain many elements:

- Logistics
- Training
- Capacity building
- Responsibilities
- Accreditation
- Costs
- Construction
- Technical assistance
- Business plan

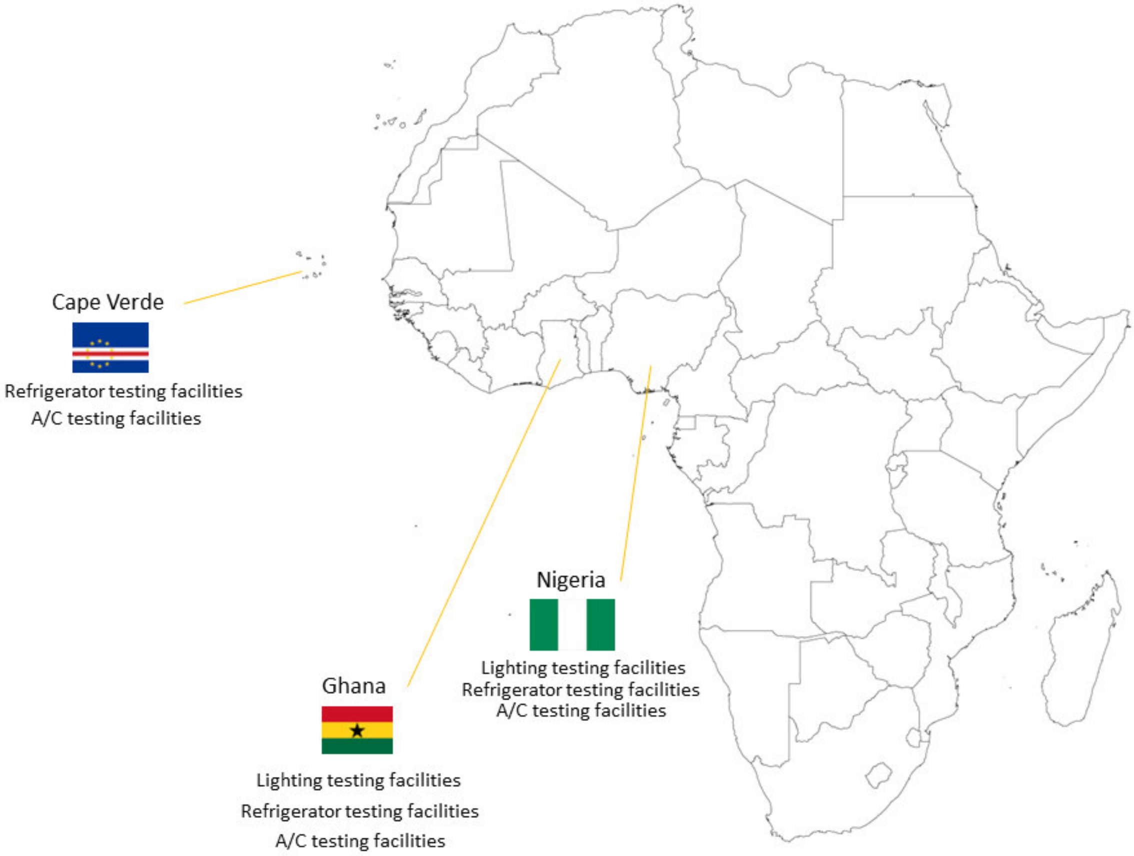


Figure 22: Internationally accredited laboratories (existing or in project) in neighboring countries

6 METHODOLOGY FOR THE PROGRAM IMPLEMENTATION

The actions to be put in place for the implementation of the program are detailed in the report on the implementation framework.

We recall in the table below the planned activities relating to the adoption of the levels of standards and energy label.

Project component	Programmed Activities	Key Implementing Agency	Supporting Agency
Component 1. Energy Efficiency Policy Enhancement	1.1 Draft, promote Government adoption and implement national policy on energy efficiency to create enabling environment for the implementation of PANEE	MIRN	MPFEA, DGRNE, AGER, SENAPIQ, AENER, CCIAS
	1.2 Draft and promote passing of bye-law concerning the creation, organization and functioning of the EE Department of DGRNE	MIRN	DGRNE, AGER
	1.3 Recruit qualified personnel and provide resources for the functioning of the EE Department of DGRNE	DGRNE	AGER
	1.4 Draft and promote passing of law concerning the creation, organization and functioning of the National Energy Certification Body or Entity (ENCE)	MIRN	DGRNE, AGER, SENAPIQ
	1.5 Recruit qualified personnel and provide resources for the functioning of ENCE	MIRN	DGRNE
	1.6 Hold consultations with Government stakeholders and constitute the PSC; clearly define their functions and establish its work plan	DGRNE	AGER, SENAPIQ
	1.7 Establish the Project Management Unit (PMU) and provide resources for its functioning	DGRNE	
	1.8 Establish a Monitoring, Reporting and Verification (MRV) system for the EE Department (DGRNE) to work with EMAE to monitor and assess the efficiency and effectiveness of the implementation of EE measures (including energy savings from use of EE appliances); MRV indicators will be disaggregated by gender for impact on women	DGRNE	EMAE, SENAPIQ

	1.9 Draft and promote passing of law to phase out incandescent lamps in STP including incentive measures	MIRN	DGRNE, AGER, SENAPIQ
	1.10. Starting the energy labeling process	MIRN	DGRNE, AGER, SENAPIQ
Component 3: Appliance Quality Improvement	3.1 Establish and provide resources to Technical Working Group (TWG) on standards and labeling of lamps, refrigerators and ACs (LRACs) within ENCE	DGRNE	SENAPIQ
	3.2 Adopt, through stakeholder consultation, minimum energy performance standard (MEPS) and labeling of LRACs	SENAPIQ	DGRNE
	3.3 Draft and promote passing of a law to establish a legal framework for enforcement of the EE labeling and standards of LRACs	DGRNE	AGER, SENAPIQ, CCIAS
	3.4 Create and provide equipment and human resource for a testing laboratory for LRACs, through collaboration with national and international universities or training centers	DGRNE	SENAPIQ, CCIAS
	3.5 Set up appliance testing procedures within the designated testing laboratory; and establish relationship with regional standards bodies in ECCAC for harmonization	SENAPIQ	DGRNE
	3.6 Establish a database of market statistics (imports etc.) and registered products on EE LRACs on the STP market	DGRNE	AGER, SENAPIQ, Customs Directorate, CCIAS
	3.7 Establish a national quality inspection system for EE LRACs involving the key institutions NQC, ENCE, AGER, SENAPIQ and Customs Directorate	SENAPIQ	DGRNE, AGER, SENAPIQ, Customs Directorate, CCIAS

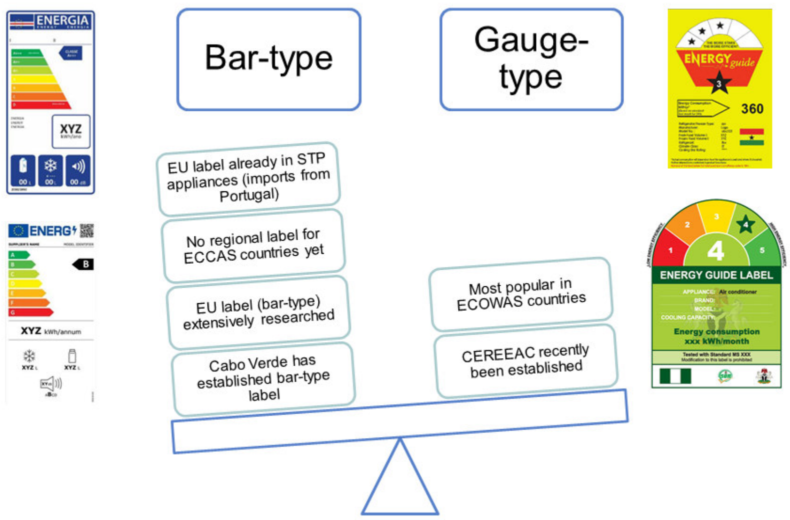
7 CONCLUSION

This report contains the analysis and methodology that are needed in order to decide on the elements of a labelling scheme for STP. Those elements are:

- Type of energy label
- Design of energy label
- Testing procedures for assurance of imported appliances
- Implementation plan for introducing the labelling scheme

For the type of the label, examples from different countries are presented, along with the elements that can help choose which type should be applied to STP. Those elements were presented during the first workshop, and were validated during the second one.

It is noteworthy that STP is one of the first countries in the ECCAS region to initiate a labelling program, at a time that CEREEAC has just been formed and has not yet active in this area for the region. In that matter, STP can be an example for other countries, and provide knowledge and know-how to other ECCAS countries through CEREEAC, proving itself as a useful ally in the energy scene of Central Africa.



After choosing the type of label, the next step is to design the actual label. Since the STP label will follow the design of the EU label, technical information and graphic (colors, symbols) details that will appear on the label must be decided. In this report, guidelines for that decision are provided. The analysis of the EU labeling program offers three important points:

1. Energy efficiency labels and MEPS must be frequently revised and rescaled, so as to follow the evolution of the market and the progress of the respective technologies
2. When creating Energy Labels, the use of the expanded ‘plus scale’ (A+, A++, A+++) should be avoided, as it is misleading and ineffective for the consumers. Instead, the A to G must be preferred
3. An up-to-date database must be maintained, containing all products and models available in the market, so as to simplify policymaking

In addition, during market research in São Tomé, we found that:

- The energy labels displayed in stores are based on European models,
- All imported products come from Portugal/China.

The European label has been developed through extended studies and research, and has proved to be very useful for consumers. As part of the European Union, Portugal is also using the EU label. This means that appliances imported from Portugal have already received the EU label through testing, and all necessary information of an appliance can be easily be provided through documentation.

Therefore it is suggested that the course of action for testing an imported appliance agrees with the STP label is the following:

- Only some appliances can be tested on a random basis, using existing testing facilities in some other countries or regions.
- Customs will check documentation provided with the appliances, when entering the country.
- STP can conduct feasibility study in order to determine whether a national testing facility is viable for the country, and whether it is financially more viable to use international laboratories for accreditation.

Finally, the implementation plan that is presented in this report was also presented during the first workshop. During the second workshop, the participants had the chance to review the implementation plan, its activities and the responsible bodies for each activity, and provide feedback.

Next steps: During the mission 4, the consultant will assist the legal bodies involved and concerned to adopt the regulatory texts (decrees, orders, testing procedures) required to implement the standards while considering regional directives and the guidelines of international standards during the next phases of the project. In this sense, the consultant will:

- Write the draft of regulatory texts
- Train institutions during webinars and workshops
- Write an argument on the interest of standards and labels for people in charge of adopting regulatory texts.

Of course, for the success of the implementation of the standards, all the actions described in the implementation plan will have to be carried out.