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Guide to Building Sustainable Testing Capacity in ECOWAS

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PARTNERS

ECOWAS Centre for Renewable Energy and Energy Efficiency

AUTHORS

Lina Kelpsaite, CLASP, with contributions from Nicole Kearney, CLASP, Etiosa Uyigue and Que Nguyen.

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Contents

Introduction

Product testing is an integral part of energy efficiency programmes. Testing helps guarantee the quality and efficacy of products and provides the evidence needed to demonstrate compliance with national or regional policies. Test results are used to check products' performance claims before they enter the market, and to verify performance claims for suspicious products found on the market during market surveillance checks.

Often, governments consider lack of access to reliable testing laboratories an impediment which can cause delays and threaten energy efficiency programme credibility, especially for nascent programmes. There is also a common belief among many governments that a national government-owned laboratory is critical to conduct product verification testing for policy enforcement. A government-owned test laboratory is also often considered a source of national pride and a deterrent to non-compliance. These governments may not consider other solutions, such as outsourcing testing, as viable alternatives and rather prioritize building an expensive test laboratory. The common assumption that a national laboratory will "pay for itself" is not always the case. Establishing a test laboratory for a regulated product requires a large upfront investment and ongoing funding for its operation. If there is little demand for product testing for market surveillance purposes, the underutilization of a facility may hinder other policy enforcement efforts, as the funds needed for laboratory upkeep and maintenance may be diverted from other activities, such as cost-effective market inspections or communications campaigns.

This Guide provides instruction on establishing sustainable testing practices for ensuring product compliance with energy efficiency programmes. Governments, donors, international organizations and other stakeholders can reference the step-wise guidance and criteria to assess whether building a national test laboratory is a viable solution or whether alternative approaches such as outsourcing testing are more appropriate. The Guide discusses different options for outsourcing testing and demonstrates that building a government-owned test laboratory should be based on a careful financial evaluation. The accompanying *Test Laboratory Financial Evaluation* tool[1] should be used to assess the financial viability of the planned test laboratory.

The focus of this Guide is on compliance (or verification) testing for market surveillance, as this is typically why countries with nascent policies or that are setting up their energy efficiency programmes often consider a government-owned laboratory most necessary. The Guide can be applied for testing practices for various regulated products.

This Guide includes considerations and targeted recommendations for the Economic Community of West African States (ECOWAS), which has adopted harmonized regional policies for cooling appliances and lighting. ECOWAS member states are at different stages of policy adoption - some have well-established programmes, others nascent programmes or are yet to develop them. These recommendations will help ECOWAS member states to build and access sustainable national and regional testing capacity which will support effective implementation of product efficiency policies, help prevent delays in adopting regional policies, strengthen enforcement, and protect markets from the inefficient and low-quality products.

ECOWAS countries should consider the following solutions before planning construction of a test laboratory:

- *Collaborate with all ECOWAS member states to build regional testing capacity.* Two regional and accredited testing centers with laboratories for cooling appliances and other regulated products can serve as testing hubs with state-of-the-art technology.
- *Use existing testing laboratories.* Three room air conditioner and two refrigerator testing laboratories are currently in operation or under-construction in Ghana, Nigeria and Cape Verde[2].
- *Use regional resources to support regional policy implementation* such as a regional product registration system (PRS)[3] for managing product registration and sharing market surveillance intelligence and test results. Effective regional collaboration can reduce the number of tests required to verify product compliance with policies in each member state.

ECOWAS member states should consider the following recommendations when planning how to address and meet their national testing needs:

Recommendation #1: **Use this Guide and Test Laboratory Financial Evaluation Tool to identify an appropriate approach for building national sustainable testing capacity for policy compliance**. The step-by-step guidance and criteria in this Guide can help identify whether a national test facility is an appropriate option, while the Tool will help evaluate its financial viability.

Recommendation #2: Utilize existing testing laboratories in Nigeria, Ghana and Cape Verde for compliance testing to support and strengthen the operation of these laboratories. By outsourcing testing to existing laboratories, countries with nascent programmes will help generate additional revenue for their operation and ongoing maintenance and improvements.

Recommendation #3: Strengthen conformity assessment processes. Robust market entry requirements such as certification and registration, and checks at the border can reduce the entry of non-compliant products into the country, significantly reducing market surveillance programme costs.

Recommendation #4: Implement low-cost market surveillance approaches. Rather than focusing on establishing a national test laboratory, member states should design and put in place strategic and resource-efficient market surveillance

[1] https://www.clasp.ngo/tools/
[2] At time of publication of this Guide.
[3] CLASP has developed a PRS for adoption and Implementation by ECOWAS.

approaches to identify and rectify non-compliance on the market.

Recommendation #5: Use regional resources and engage in regional collaboration efforts. Adopting readily-available regional tools such as a regional PRS and engaging in market intelligence sharing can minimize the costs and burdens of national compliance efforts.

Recommendation #6: ECREEE should coordinate and support development of regional testing capacity to accelerate and facilitate regional policy implementation.

Testing for Energy Efficiency Programmes

Reliable test procedures and test laboratories that provide consistent and accurate results are the foundation of successful energy efficiency programmes

1.1 ROLE OF TESTING

Governments set energy efficiency policies with performance requirements for products, including minimum energy performance standards (MEPS) and labeling levels,[4] to achieve policy targets such as reducing energy use and curbing carbon emissions. Performance testing of products is conducted to provide the evidence needed to demonstrate compliance with these national or regional energy efficiency policies. Testing is performed in a laboratory following a specified test method, which is usually developed by international standards organizations or national standard body.

The purpose of testing is to:

- Enable governments and other stakeholders to accurately verify product performance, and ensure that products meet MEPS and labelling criteria,
- Help safeguard policy benefits, and
- Protect credibility of and maintain consumer confidence in energy efficiency policies.

Testing is conducted at different stages:

- **During product development and design** –manufacturers test their products throughout the technology development phase to improve their products and ensure they meet design specifications and regulatory requirements.
- **When setting MEPS and labeling levels** – policy makers can test products available on the market to set appropriate performance levels for regulated products.
- **To qualify for market entry, incentives or bulk procurement programmes**– testing can be done by industry (manufacturers and importers) or governments to secure a certificate or declaration of conformity with energy efficiency requirements and to gain access to the market. Providing test report may also be prerequisite for the products to qualify for bulk procurement and awards programmes.
- **To verify compliance of products on the market –** testing can be done by governments, industry (including competitors), consumer groups and civil society to verify product's claimed performance and to provide justification for any enforcement action taken to correct non-compliance with energy efficiency requirements.

Verification testing for market surveillance. Market surveillance involves identifying and removing non-compliant products from the market, to ensure products meet energy efficiency requirements, industry operates on a competitive and fair market, and that consumers can trust product performance claims.

Compliance authorities select suspicious products from the market and test them to verify whether the performance claimed by the manufacturer is accurate and whether the indicated efficiency rating on the energy label is correctly reflected. Testing products is costly and the number of products that can be tested is therefore limited by the programme budget. For this reason, risk-based criteria should be used to help identify products at high-risk of non-compliance. The budget for market surveillance should not be allocated solely for verification testing, but should also cover other cost-effective efforts such as label and document inspections to improve product compliance with regulatory requirements.

Testing products suspected of non-compliance is commonly funded by the energy efficiency programme's budget. For example, Australia and Singapore fund verification testing with their government-allocated market surveillance budget. In some countries, manufacturers or suppliers are required to pay for some or all verification testing costs when authorities select them during market inspections. For example, the Electricity Generating Authority of Thailand requires suppliers to cover the cost of purchasing the potentially non-compliant products for verification testing.

The focus of this guide is on verification testing for market surveillance, as this is often why countries with nascent policies or that are setting up their energy efficiency programmes consider a government-owned laboratory most necessary.

1.2 TESTING OPTIONS FOR PRODUCT ENERGY EFFICIENCY PROGRAMMES

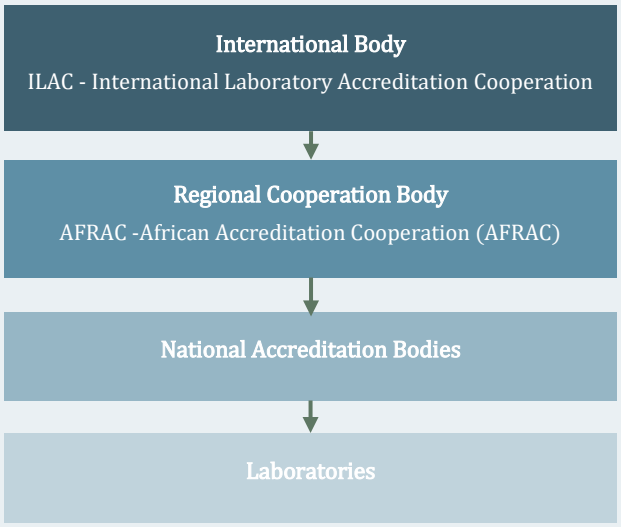
Countries have access to different test laboratories to verify if products comply with energy efficiency requirements. These include:

- **In-country government-owned laboratory** – these are usually housed in standards bureaus or other government institutions. The laboratory can provide services such as testing products for compliance, research and development, and can provide testing services for industry and other stakeholders. A government can establish its own laboratory, if there is a significant need for product testing, available funding, and a plan for the laboratory to operate sustainably and maintain its competence. The laboratory should obtain and maintain accreditation as discussed in Figure 1. Refer to section 2.2 for more information on building a business case for establishing a national test laboratory.
- **Third-party test laboratories**, which include:
    - In-country and foreign private laboratories (e.g. TÜV, Intertek, UL, CEIS)
    - Other independent laboratories such as those in academic institutions (e.g. The Riverside Energy Efficiency Laboratory at Texas A&M University)
    - Government-owned laboratories in other countries (e.g. refrigerator laboratory at Ghana's Standards Authority)

  Outsourcing compliance testing to third-party testing laboratories can be a cost-effective alternative to building a national test laboratory. Third-party laboratories accredited by national or regional accreditation bodies to relevant standards (Figure 1) can provide competent and competitive testing services. The government can use a competitive tender process to select one or more testing laboratories and sign agreements to outsource their product testing needs. Governments adopting this approach will also incur shipping and customs costs, if the laboratories are based in other countries.
- **Regional testing centers** – if there are established regional testing centers to support regionally harmonized policy implementation, testing can be outsourced to these centers. This is especially key when countries in the region commit to using these regionally-funded centers supported by other collaboration platforms (e.g. in ECOWAS, two regional testing centers are being considered to support the regional policy implementation for cooling appliances). Alternatively, governments looking to invest in testing capacity may also contribute to and provide co-funding to set up accredited and high-quality regional testing centers, rather than investing in a smaller and potentially unaccredited in-country test laboratory.

FIGURE 1. HIERARCHY OF ACCREDITATION BODIES AND TYPES OF LABORATORY ACCREDITATIONS[5].

Laboratory Accreditation. Laboratories should plan to obtain accreditation, which is an internationally accepted framework to verify they have an appropriate quality management system and can properly carry out testing to recognized test methods. Obtaining laboratory accreditation is a specialized process done by a competent and recognized accreditation body. The International Laboratory Accreditation Cooperation (ILAC) is an international organization of accreditation bodies that oversees the accreditation of conformity assessment bodies including laboratories. The organizational arrangement of accreditation bodies under ILAC is shown below.



TWO TYPES OF LABORATORY ACCREDITATIONS

- Managerial accreditation, typically per *ISO/IEC 17025 General requirements for the competence of testing and calibration laboratories*, which is the international standard for laboratory proficiency accreditation to show that laboratory and testing activities meet the highest standard.
- **Technical accreditation** is provided for testing specific products with a specific test method standard for the product type to determine compliance. Technical accreditation is given on a test-by-test basis, not on a facility basis.

Products should always be tested at an accredited laboratory or a laboratory that is seeking accreditation, which ensures that the laboratory is competent to provide consistent, accurate, and reliable test results.

It is **NOT** recommended to use manufacturer testing laboratories to verify product performance and compliance with regulatory requirements, unless the test laboratory is accredited and has strong quality controls and procedures in place, such as allowing a witness to oversee the testing process. Manufacturer laboratories are not independent testing laboratories, which can reduce confidence in accuracy and reliability of the test results.

5 Not to be confused with certification, which is used for verifying that personnel have adequate credentials to practice certain disciplines, as well as for verifying that products meet certain requirements. (https://www.nist.gov/nvlap/accreditation-vs-certification), and 5 https://ilac.org/about-ilac/

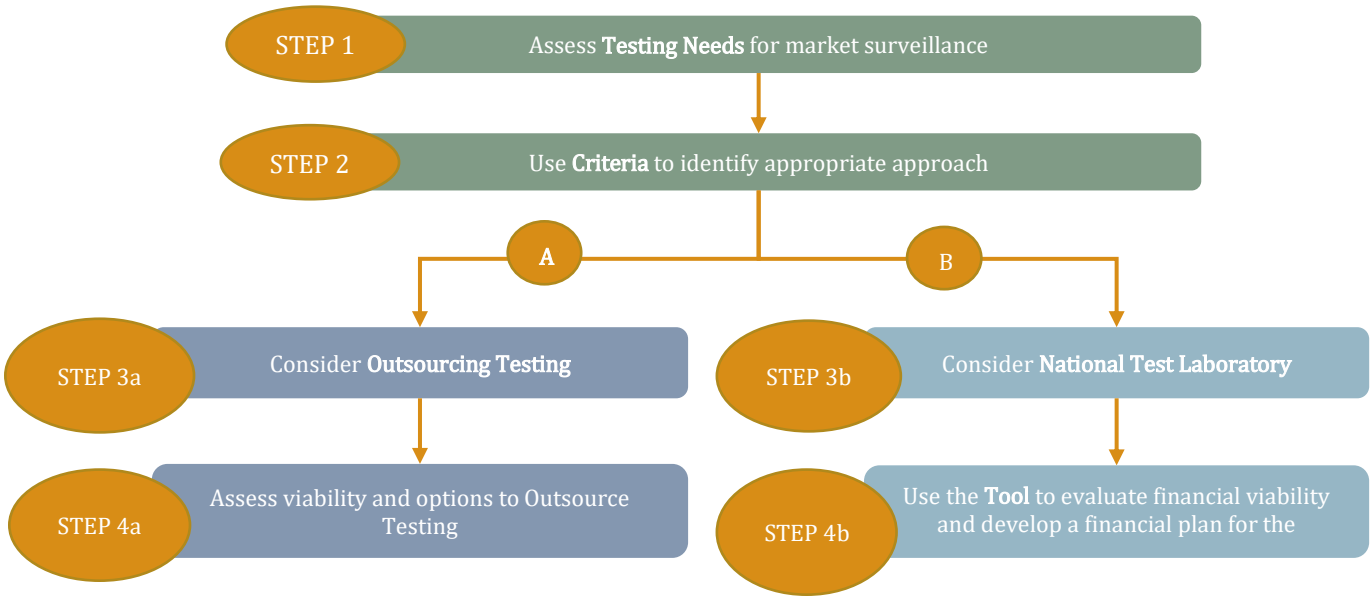
Sustainable Compliance Testing for Product Energy Efficiency Programmes

Before establishing a test laboratory, a Government should first consider its testing needs, objectives and available resources, to help identify an appropriate approach for compliance testing

2.1 SELECTING AN APPROPRIATE APPROACH FOR SUSTAINABLE COMPLIANCE TESTING CAPACITY

Governments should take the steps outlined in Figure 2 when selecting a sustainable and appropriate approach to meet compliance testing needs for energy efficiency programmes. The two most common approaches are to outsource testing to regional centers and other third-party laboratories, or to establish a government-owned national test laboratory. This step-by-step guidance is intended to enable governments to better evaluate where and how to test products and make better-informed decisions about how best to allocate limited resources.

FIGURE 2. RECOMMENDED STEPS TO EVALUATE APPROACH FOR COMPLIANCE TESTING



STEP 1. First, governments should carefully assess the testing needed under their energy efficiency programme for a particular product – to estimate how many products will be tested at the start of the programme and also forecast the number of future tests as the programme matures and the market grows. The market surveillance programme budget should be considered when estimating the anticipated number of verification tests. Key questions to consider are:

- How many tests are expected on an annual basis for verification testing?
- Is the laboratory expected to perform commercial tests for manufacturers, importers and other third-parties, and if so, how many commercial tests are expected annually?
- Is the laboratory expected to perform tests for other regional or foreign governments, and will those governments sign agreements such as mutual recognition agreements to commit to use the laboratory's testing services?

STEP 2. Next, the governments should use the criteria shown in Figure 3 to evaluate the resources, market and other variables to determine, which approach would be more suitable. Using these criteria is an effective first step to rule out or confirm whether a building national test laboratory will be a sound national investment.

For example, a country with an established energy efficiency programme and a confirmed need for extensive testing, sufficient and sustainable programme budget, and a large product market with local manufacturing could be well-positioned to build a national laboratory, especially if there is a need for commercial testing services which can help secure an ongoing revenue stream. On the other hand, a country with a nascent programme and limited budget, and small import market may choose to outsource testing to a regional testing center, if available, or a foreign test laboratory, rather than investing strained resources in a facility that cannot be sustained in the long term.

FIGURE 3. CRITERIA FOR BUIDLING TEST LABORATORY OR USING ALTERNATIVE APPROACHES FOR TESTING.

	Outsource Testing: REGIONAL TESTING CENTER	Outsource Testing: OTHER ACCREDITED LABORATORIES	Building Test Laboratory: NATIONAL LABORATORY
Number of Tests for Market Surveillance per Year (anticipated)	Unknown Few Large Full-capacity	Unknown Few Large	Large Full-capacity
Appliance Market Type	Import market Large local manufacturing base	Import market Large local manufacturing base	Large local manufacturing base
Appliance Market Size	Small Large	Small Large	Large
Entry points for entry to region/port	No Port Import Port Major import Port	No Port Import Port Major import Port	Major import Port
Regulatory Framework for Energy Efficiency Programme	Under-development Nascent Established Well-established	Nascent Established Well-established	Established Well-established
Established regional collaboration and testing center	Yes	No	Yes No
Allocated Budget for Laboratory Operation	Limited or no allocated budget	Limited or no allocated budget	Secured annual funding
Sustainability	Strong collaboration with countries in the region	Established MRAs and/or agreements with laboratories	Anticipated sufficient revenue from commercial testing to cover laboratory costs

-A- Outsourcing Testing

STEPS 3a and 4a. If outsourcing testing is the more optimal option, governments should follow steps 3a and 4a in Figure 2 to consider the viability of outsourcing testing to a regional testing center, when established, or other accredited third-party[6] test laboratory.

If a *regional testing center* is established, countries in the region can effectively use it for testing, especially in regions with harmonized policies. These centers can be established at existing laboratories that already test regionally regulated products and that are jointly supported or funded by the countries in the region. Other regional platforms and mechanisms should be considered when using a regional test laboratory, such as sharing of test results with other countries collaborating with and using the regional testing center.

Third-party laboratories, which are discussed in section 1.2, that are accredited to test products to the required standards can be also used for outsourcing testing. Governments can select a laboratory through competitive tenders and set up agreements with them.

Case study: Singapore outsources testing. Singapore's National Environment Agency (NEA) is responsible for market surveillance for product energy efficiency. In 2014, NEA outsourced testing of 46 air conditioners selected from the market to a local private laboratory, TÜV SÜD PSB Pte Ltd (TÜV SÜD), accredited by the Singapore Accreditation Council (SAC), to verify their claimed performance. TÜV SÜD tested 26 products locally, and sub-contracted a laboratory in Guangzhou, China to test the remaining 20 models. Singapore was able to cost-effectively export some of the testing to China, because the test laboratory in Guangzhou was accredited by the China National Accreditation Service for Conformity Assessment (CNAS), which has signed a mutual recognition agreement with the SAC in Singapore.

Governments should assess the feasibility and potential challenges associated with outsourcing testing including:

- National legislation - whether the outsourcing of testing is permitted.
- Costs - including costs for shipping, import dues and testing the products.
- Shipping and customs - available solutions for safely shipping the products, time, requirements and potential issues for importing the product into a foreign country.

Mutual recognition agreements (MRAs) are agreements between two or more countries to recognize each other's laboratories and test results from these laboratories[7]. MRAs are set between the governments. The MRA's can reduce time and cost to place products on different markets; and encourage information sharing among industry, regulatory authorities and test laboratories[8].
There are two different types of MRAs:

- Bilateral MRA can be set up between two governments to accept test results provided by the laboratory that is recognized in the other country. This approach can save money for governments that import most of their products.
- Regional MRA, which is a cost-effective approach to testing for regions that have harmonized test methods, as test reports can come from any accredited test laboratory in the region that is accredited by the accreditation bodies in the region and recognized under the regional MRA.

Governments can also set a requirement to use and accept results from laboratories listed under the ILAC MRA. The ILAC MRA has been developed and signed by 102 accreditation bodies from over 100 economies to make use of a global network of accredited testing and calibration laboratories and inspection bodies to provide accurate and reliable testing results.[9]

Case study: U.S. ENERGY STAR programme uses MRAs. MRAs are becoming more popular for product energy efficiency programmes as global product supply chains become more distributed. In the United States, the ENERGY STAR programme leverages MRAs to identify laboratories accredited to the relevant international standards such as ISO 17025. According to the U.S. Environmental Protection Agency (EPA) that administers the ENERGY STAR programme, "Referencing the ILAC MRA took the EPA off the hook for developing a lot of criteria for laboratories or conducting our own lab oversight. And, by working with only ILAC signatories, we have the confidence that the laboratories have been appropriately assessed. We now recognize 27 ILAC-signatory accreditation bodies around the world." The key benefit of the MRA is that the results from an accredited laboratory under the MRA are able to be recognized by each country that is a signatory to the MRA.

Source: UL

-B- National Test Laboratory

STEPS 3b and 4b. If establishing a national government-run test laboratory is the most appropriate option, then as a next step the government should assess its financial viability to support the laboratory in the long term. Governments should refer to the *Test Laboratory Financial Evaluation Tool (Tool)* to assess the feasibility and sustainability of the facility under consideration and develop a long-term financial plan and business case to fund its operation. Refer to section 2.2 for more information on considerations when evaluating financial viability and building a business case for a national test laboratory.

Utilizing Regional Resources to Support Policy Compliance. Regional collaboration can support national energy efficiency policy compliance efforts. Working with other countries in the region can especially benefit programmes that are still under-development, or nascent and low-resourced programmes. Regional information sharing and exchange of market intelligence on non-compliant products, including market surveillance and verification testing information conducted in one country, can reduce the need for another country to test products for compliance. This can in turn reduce the required testing budget so funding can be relocated to other, less-expensive and effective market surveillance efforts. The following tools and approaches can be effectively used to support regional collaboration:

- *Product registration system (PRS)* – use a PRS or other similar mechanism to share product information, compliance intelligence and test results. This information exchange may be also done informally among compliance authorities on a bi-lateral basis.
- *Collaborative platforms* – share lessons learned through a regional network, online discussion forum, meetings and workshops hosted by a regional body or organization.
- *Coordinated compliance activities* such as joint testing programmes, sharing market surveillance strategies and plans, and implementing coordinated market surveillance and enforcement activities.

Such collaborative programmes allow governments to work together to identify non-compliant products, maximize programme efficiency, and strategically allocate resources on the national and regional level. If the same product models are sold across borders, sharing this information can alert neighbouring compliance authorities to take action and reduce the need to conduct additional testing. For example, Australia and New Zealand share product compliance information through a common registration system

2.2 BUILDING A CASE FOR NATIONAL TEST LABORATORY

Building a national laboratory is a logistically, administratively and financially challenging undertaking. Careful planning is necessary to ensure its sustainable operation and competence. The decision to build a laboratory should be financially viable and grounded in a business case[10]. The governments should use the *Test Laboratory Financial Evaluation Tool* to help build their business case. *The Tool* compares the initial investment and operation and maintenance costs with the expected revenue and the required financial commitment to operate the laboratory.

Revenue and Funding Sources. During the planning process it is important to not only secure the initial investment to establish the laboratory, but also to have a long-term plan to finance ongoing operation of the facility. Intermittent or part-time operation of a test laboratory is impractical, as only limited or no additional income will be collected, yet it will require a regular investment to maintain accreditation and competency of the laboratory.

The following are common funding sources:

- *Donor funding* – international donors or allocated funding through certain international support programmes can fund laboratory set up. E.g., in Ghana, the test laboratory for refrigerating appliances was funded by a UNDP/GEF project.[11] Usually, such funding comes as grant and does not require repayment.
- *Government* – the establishment and operation of the laboratory can be funded from the government budget. E.g. in Sweden, the Swedish Energy Agency invested in equipment and staff competency to enable full energy efficiency testing for select products.[12] If sufficient revenue is not anticipated, the government must be able to

10 In the private sector, it is common practice to assess whether a laboratory will be a profitable and sustainable investment. The companies that provide third-party laboratory services conduct due diligence processes to ensure return on investment when considering investing in a new test laboratory. Private laboratories are not built in places that are not expected to generate sufficient income. Governments should follow suit and take a similar approach before investing in a national government-run test facility.
11 UNDP, Promoting of Appliance of Energy Efficiency and Transformation of the Refrigerating Appliances Market in Ghana, http://www.gh.undp.org/content/ghana/en/home/operations/projects/environment_and_energy/Susdevclusterprojects/
12 SEAD, 2019. Costing study findings, https://clasp.ngo/publications/sead-global-appliance-testing-costs-catalogue.

make a long-term financial commitment to support ongoing operation of test laboratory through annual budget allocation[13].

- *Testing revenue* – the operation of the laboratory can be supported by the revenue received from providing testing services for industry, research and other governments in the region that seek to outsource their testing operations. The revenue from commercial testing services can cover some of the ongoing costs. The expected revenue should be assessed before constructing the laboratory, bearing in mind that the demand for commercial testing might fluctuate depending on industry and programme needs, competition from other laboratories and testing costs among others.

Testing Prices. Prices to test cooling products can vary greatly depending on different factors such as product type, test method, and the region. The price to test products at an accredited laboratory is higher than in a non-accredited laboratory. According to a SEAD[14] Initiative study, indicative prices to test room air conditioners (AC) at an accredited laboratory range from 350 USD to 11,101 USD, and to test refrigerator between 480 USD and 3,000 USD[15]. Table 1 shows the variation in testing prices for different regions, which are impacted by factors including complexity of test requirements, product characteristics and design features, compressor type, and laboratory ownership.[16]

TABLE 1. INDICATIVE PRICES TO TEST ROOM AIR CONDITIONER AND REFRIGERATOR[17].

Technology	MENA		Africa		Asia		LAC		Other Regions	
	Low	High	Low	High	Low	High	Low	High	Low	High
ACs	$1,040	$8,057	N/A		$350	$6,825	$450	$3,360	$4,733	$11,101
Refrigerators	$480	$2,939	N/A		$885	$2,500	$930	$3,000	$1,770	$2,360

Costs of Building and Maintaining the Laboratory. Setting up a laboratory is an involved and complicated process requiring knowledge of equipment, its installation and procurement process. Professional expertise and assistance is recommended to ensure that the correct equipment is purchased, that it is correctly installed, and that quality training is provided for the staff.

The laboratory establishment costs include:

- *Construction* of the facility such as erecting a laboratory building or renovating the existing laboratories to accommodate a new laboratory.
- *Procurement of specialized equipment* for testing a specific product. The import duties should be considered as these may be steep for the equipment made overseas.
- *Building human capacity*, which requires investment of resources and time to train the technicians to operate the laboratory, maintain the equipment, test the products and produce reliable test reports.
- *Obtaining qualifications*, which includes accreditation of the laboratory after it is commissioned and participation in proficiency testing exercises such as inter-laboratory comparison exercises.

The main costs associated with the operating the laboratory are:

- *Ongoing operation and maintenance* of the laboratory and equipment including rent, utilities, replacement and calibration of the equipment.

13 UNEP, Performance testing of Lighting Products, Guidance Note, 2016.
14 The Super-efficient Equipment and Appliance Deployment (SEAD) initiative. http://www.cleanenergyministerial.org/initiative-clean-energy-ministerial/super-efficient-equipment-and-appliance-deployment
15 The prices are not necessarily comparable as they were collected during interviews with both accredited and non-accredited laboratories.
16 CLASP collected testing price data from national and private laboratories, available here, https://clasp.ngo/publications/sead-global-appliance-testing-costs-catalogue.
17 https://clasp.ngo/publications/sead-global-appliance-testing-costs-catalogue

- *Retention and on-going training of technical staff*
- *Laboratory re-accreditation* – an accreditation requires renewal after it expired, usually every four years.

A SEAD Initiative study found that the cost of setting up an air conditioner or refrigerator test laboratory can exceed 600,000 USD. The costs of building and operating a test laboratory are relatively consistent across the regions. Greater variation among the regions may be found for the costs to retain staff and space, such as lease or rent[1].

Technology	Capital Costs (USD)		Operational Costs (USD)
	Low	High	
ACs	$363,000	$665,000	$12,000 + Staff & Space
Refrigerators	$265,000	$617,000	$4,000 + Staff & Space

Time. If a national test laboratory has been justified and sufficient resources are secured, a significant time investment is still required to build the facility, and for staff to acquire familiarity with testing equipment and methods. Trial runs to ensure that test laboratory is set properly often take six months or more. Accreditation, which can start after a laboratory becomes operational, can be a lengthy process. All of this should be complete before a laboratory can begin official product testing.

Sustainable Compliance Testing for Product Energy Efficiency Programmes

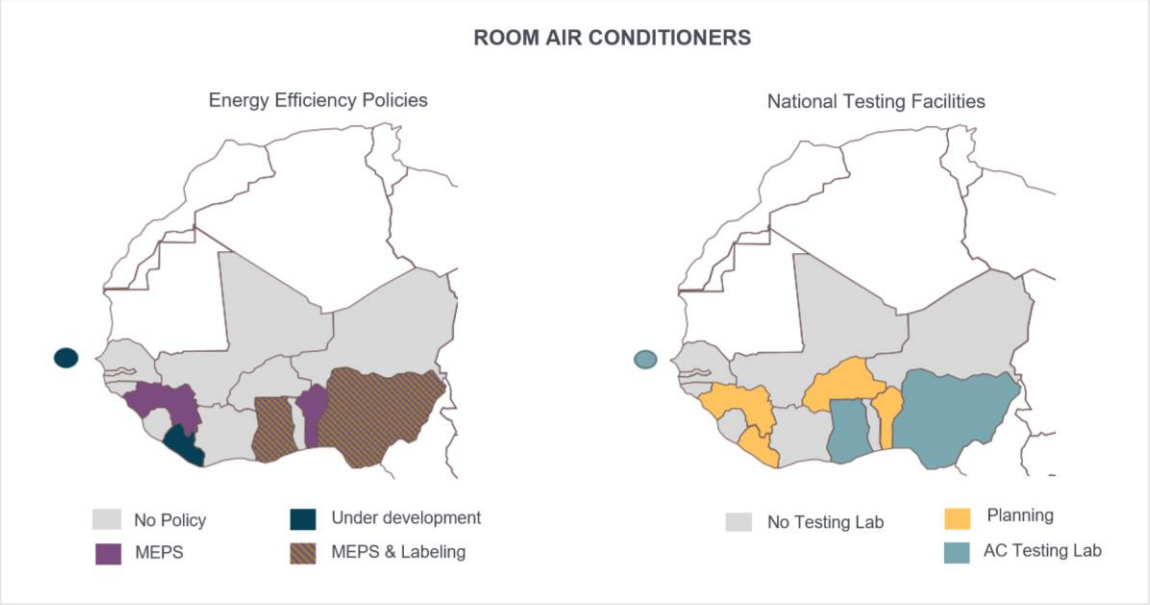
ECOWAS member states with programmes under-development or with nascent policies should consider outsourcing compliance testing to existing testing laboratories

3.1 RECOMMENDATIONS FOR BUILDING SUSTAINABLE REGIONAL TESTING CAPACITY IN ECOWAS REGION

With support from the Kigali Cooling Efficiency Program and in collaboration with ECREEE, CLASP assessed current testing capacity in ECOWAS countries, as well as ongoing efforts to build up national and regional testing capacity. Our recommendations for building sustainable regional testing capacity to support harmonized energy efficiency policy implementation for cooling appliances[18] in ECOWAS are set out below.

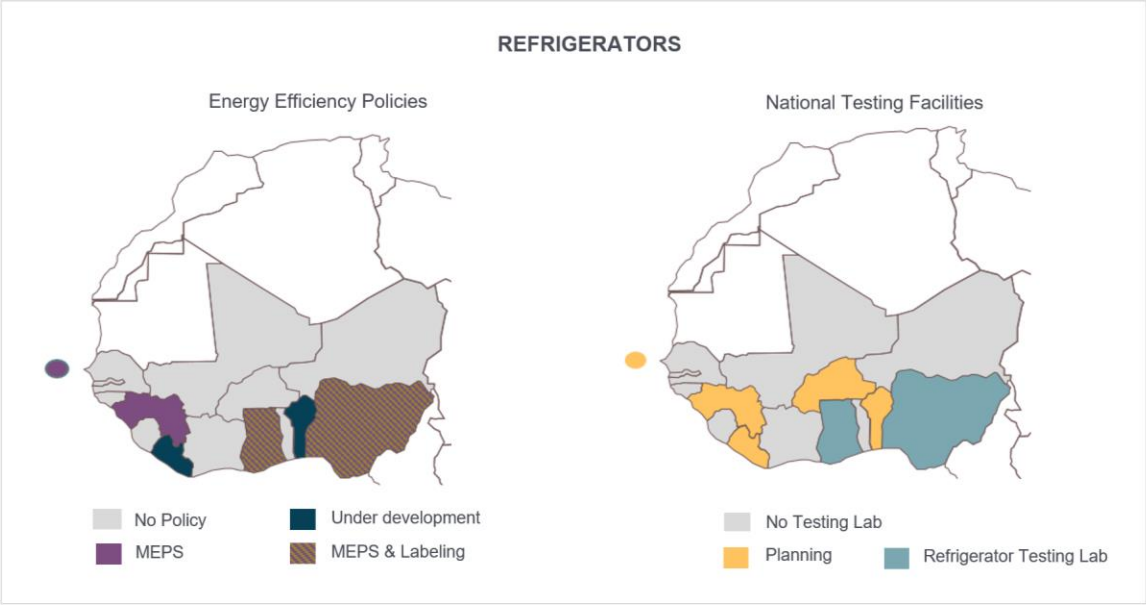
Five countries[19] (Figure 4, Figure 5) with nascent policies or programmes that are still under-development have decided to prioritize building their own national test laboratories. There are already three existing or under-construction testing laboratories for air conditioner and two for refrigerators in the ECOWAS region. Establishing many testing laboratories in West Africa where cooling appliance markets are still small, efficiency policies have not yet been adopted or implemented, and where governments are yet to develop implementation and enforcement strategies would not be sustainable nor practical. The laboratories may remain underutilized with limited resources for operation, equipment maintenance and staff retention, and could potentially drain budgets that could be more effectively used for other less costly policy enforcement efforts.

FIGURE 4. STATUS OF ENERGY EFFICIENCY POLICIES AND TESTING CAPACITY FOR ROOM AIR CONDITIONERS IN ECOWAS REGION[20].



[18] Room air conditioners and refrigerators
19 Cape Verde, Benin, Guinea, Liberia and Burkina Faso
20 World map by www.freeworldmaps.net

FIGURE 5. STATUS OF ENERGY EFFICIENCY POLICIES AND TESTING CAPACITY FOR REFRIGERATORS IN ECOWAS REGION[21].



Before planning construction of a national laboratory, each ECOWAS member state should deliberate the following considerations and determine whether existing laboratories and efforts could meet their testing needs for policy compliance:

- **Collaborate with all ECOWAS member states to build regional testing capacity**. The ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE) is working to build the necessary infrastructure, including adequate testing capacity in the region, to accelerate the adoption of regional policies ACs and refrigerators. The draft *Roadmap for the Implementation of Regional Minimum Energy Performance Standards (RMEPS) for Electrical Appliances and Equipment in the ECOWAS Area* provides a plan for building regional testing capacity for regionally regulated products including two regional testing centers that would serve as testing hubs with state-of-the-art technology to deliver accredited and more complex testing than national laboratories. The location for the centers will be considered based on language (French- vs. English-speaking countries) and geographical location.
- **Use existing testing laboratories.** There are three room air conditioner and two refrigerator testing laboratories in operation or under-construction in ECOWAS. Both Ghana and Nigeria are procuring testing laboratories for air conditioners and Cape Verde has an unaccredited AC testing laboratory. Nigeria is in the process of commissioning a refrigerator test laboratory, while Ghana already has one and is interested in providing its testing services to other countries.
- **Use regional resources to support regional policy implementation.** ECREEE, with support from CLASP, has developed a regional product registration system (PRS) for cooling appliances, an online database that registers and tracks cooling appliances entering each country. When ECOWAS and the member states adopt the PRS, participating countries will be able to manage registrations for products placed on the West African market, and share policy compliance intelligence and test results with one another. This will enable those with fewer resources to benefit from the efforts of more active countries.

Keeping in mind the above considerations and the status of energy efficiency programmes in the region, the following recommendations to build sustainable regional and national testing capacity for policy compliance, which are both cost-effective and sustainable:

21 World map by www.freeworldmaps.net

Recommendation #1: Use this Guide and the Test Laboratory Financial Evaluation Tool to identify an appropriate approach for building national sustainable testing capacity for policy compliance. When developing compliance mechanisms to implement energy efficiency policies for cooling appliances, governments should the guidance and criteria in section 2 of this Guide to assess an appropriate approach to meet the testing needs for their efficiency programme. Countries with small import markets, nascent programmes and small budgets should first consider outsourcing testing to existing laboratories in the region, e.g. laboratories in Ghana, Nigeria or Cape Verde. When the regional testing centers start their operation, countries can outsource testing to these laboratories. Outsourcing of testing can be done under contractual agreements and under bilateral or regional MRAs. Regulators should also keep in mind that the increase in testing may prompt private entities to establish private laboratories in the region, which regulators can also contract to do cost-effective compliance testing.

Countries with large markets, local manufacturing and significant programme funding can consider building a national testing laboratory. These countries should use the *Testing Laboratory Financial Evaluation Tool* to evaluate the financial viability of building a new facility – to determine whether there is sufficient initial investment and ongoing funding to support operation and competency of the laboratory. These governments should also develop a long-term financial plan and consider providing commercial testing services to generate revenue for ongoing operation of the laboratory.

As the energy efficiency programmes and the appliance markets grow in the ECOWAS region, additional testing laboratories may be needed to meet the growing testing demand for policy compliance. Governments can use this Guide and *the Tool* to reevaluate the case for building an in-country test facility.

Recommendation #2: Utilize existing testing laboratories in Nigeria, Ghana and Cape Verde for compliance testing to support to support and strengthen the operation of these laboratories. Building a fully functioning air conditioner or refrigerator test laboratory is expensive and may not be justifiable for countries with smaller markets and no existing local manufacturing. Rather, countries with nascent programmes can support the operation of existing laboratories by outsourcing testing to them. The refrigerator laboratory in Ghana is willing and able to provide testing services for other countries in the region. Additional revenue will help existing laboratories fund their operations and maintain competence to provide accurate and reliable test results to the whole region.

Recommendation #3: Strengthen conformity assessment processes at the major appliance import points. Robust appliance entry requirements such as certification and registration, and attentive checks at market entry points are key for effective policy compliance for all ECOWAS members, especially for countries that import all their appliances. Reducing the number of non-compliant products entering the country translates to less effort and fewer resources needed for market surveillance and enforcement. Therefore, less testing would be required to verify compliance of appliances on the market, which means those testing needs can be easily outsourced to regional centers or other laboratories.

Recommendation #4: Implement low-cost market surveillance approaches. Rather than prioritize establishing testing laboratories, countries should design and put in place strategic and resource-efficient market surveillance approaches such as document and appliance labeling inspections at retail stores.[22] These are effective methods to identify and target non-compliance on the market. Only highly suspicious products with a high-risk of non-compliance should be tested to verify their performance, as testing is the most expensive market surveillance approach.

Recommendation #5: Use regional resources and engage in regional collaboration efforts. Adopting readily-available regional tools such as a regional PRS and engaging in market intelligence sharing can minimize the cost and burden of national compliance efforts and reduce resource requirements for market inspections and appliance verification testing. ECOWAS member states are not obligated to share verification test results with other countries, but the benefits of sharing these results with other members are significant. Collaboration and compliance information sharing among neighbours can help reduce unauthorized imports into the region. Accepting test results from other countries under bi-lateral or regional MRAs can further strengthen national compliance efforts. Regional efforts are key in helping accelerate standards implementation, especially in countries without existing policy frameworks.

Recommendation #6: ECREEE should coordinate and support development of regional testing capacity. As the driver of the regional energy efficiency programme, ECREEE should support member states in developing sustainable testing capacity including encouraging them to use *the Tool* to make a case for any new laboratories. ECREEE should also consider developing a regional MRA to facilitate acceptance of testing results among ECOWAS countries, and collect and share information on available testing laboratories, their competencies and best practices for outsourcing testing. ECREEE should consider building-up existing laboratories to establish regional testing centers and use *the Tool* to assess the feasibility of investing in the planned regional testing laboratories.

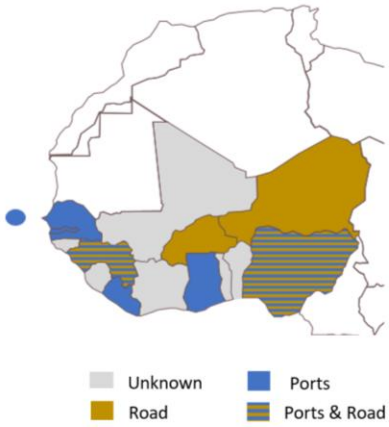
22 See Market Surveillance for Air Conditioners: Voluntary Guidelines for ASEAN Member States for more Information on designing market surveillance programmes: https://clasp.ngo/publications/the-market-surveillance-for-air-conditioners-voluntary-guidelines-for-asean-member-states.

Appendix A: ECOWAS Regional Energy Efficiency Policies and Testing Capacity for Cooling Appliances

Cooling appliances markets. ECOWAS is an important region in Africa encompassing 15 Member States.[23] However, the regional room air conditioner (AC) market is relatively small, estimated at about 700,000 units in 2018, with the largest room AC markets shares in Nigeria and Ghana, which were 444,000 and 113,000, respectively[24]. In 2018, Liberia imported 8,016 AC units and 22,930 refrigerators, while Burkina Faso imported 50,000 AC units and just over 200,000 refrigerating appliances including deep freezers[25].

Nigeria is the only country in the region that manufactures ACs that are sold both domestically and intra-regionally. All other member states exclusively import room ACs and refrigerating appliances primarily through their ports (Figure A-1). The imports mainly come from China as well as other Asian countries, the European Union countries, United Kingdom and the United Arab Emirates.

FIGURE A-1. ROOM AIR CONDITIONER AND REFRIGERATOR IMPORTS IN ECOWAS



Member State	Room ACs & Refrigerators Imports
Ghana	China, Turkey
Nigeria	China, European Union, South Korea, USA
Senegal	China, France, Turkey, Italy
Sierra Leonne	China, United Arab Emirates, Belgium, Hong Kong, USA, United Kingdom
Liberia	China (mainly)
Burkina Faso	France, South Korea, Malaysia, Japan
Guinea	China, France, United Arab Emirates, Morocco, other African coutries
Niger	China, France, Japan

Note: These imports may include second-hand appliances

Regional appliance energy efficiency harmonization efforts have been led by the ECOWAS Regional Centre for Renewable Energy and Energy Efficiency (ECREEE) in collaboration with partners and policymakers in the member states. These efforts aim to improve energy efficiency in the region to match international levels and free-up 2,000 MW of power generation capacity by 2020 as stated in the *ECOWAS Energy Efficiency Policy (EEEP)*[26]. ECREEE has already initiated and developed several regional efficiency policies, including MEPS for room ACs and refrigerators[27]. However, adoption and implementation of these policies at the national level is challenging, as the member states are not mandated to adopt regional standards due to lack of regional legislation mandating harmonized regional policy adoption. Other obstacles delaying the adoption of regional MEPS include lack of awareness of regional standards, lack of capacity, resources and legal frameworks on national levels, and lack of agency cooperation at the national and regional levels[28]. In 2018, ECREEE developed a draft *Roadmap for the Implementation of Regional Minimum Energy Performance Standards (RMEPS) for Electrical Appliances and Equipment in the ECOWAS Area (The Roadmap)*, which is yet to be finalized. The roadmap was developed to help overcome these challenges and provide a plan for the member states to adopt and implement regional appliance MEPS at the national level and set up their efficiency policy implementation and enforcement frameworks. In 2019, ECREEE prepared a draft regional *Directive for Minimum Energy Performance Standards and Labeling for Electrical Appliances and Equipment in the ECOWAS Member States (Directive)*, which

23 Benin, Burkina Faso, Côte d'Ivoire, the Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, and Togo.
24 JRAIA, 2019, World Air conditioner Demand by Region: https://www.jraia.or.jp/english/World_AC_Demand.pdf
25 Only limited data is available on cooling appliances imports and sales in ECOWAS member states.
26 ECREEE, 2012. ECOWAS Energy Efficiency Policy. http://www.ecreee.org/sites/default/files/documents/basic_page/ecowas_energy_efficiency_policy.pdf, accessed on January 6, 2019.
27 ECREEE, October 2018. draft Roadmap for the Implementation of Regional Minimum Energy Performance Standards (NRPEM) for Electrical Appliances and Equipment in the ECOWAS Area.
28 ECREEE, October 2018. draft Roadmap for the Implementation of Regional Minimum Energy Performance Standards (NRPEM) for Electrical Appliances and Equipment in the ECOWAS Area.

outlines the implementation of the regional efficiency regulations for the household appliances including ACs and refrigerators. As of now, the Directive is set to be voluntary.

Additionally, the West African Economic and Monetary Union (WAEMU),[29] which has eight French-speaking West African members, has been developing an energy efficiency labeling scheme for household appliances including ACs and refrigerators. This framework, developed at WAEMU regional level, would establish a voluntary programme that the member states can adopt[30]. As of early 2021, the WAEMU regional labeling scheme is still under development.

Regional resources to support regional policy implementation. ECREEE with support from CLASP has developed the Regional Product Registration (PRS) System for cooling appliances, which is an online database that registers and tracks cooling appliances entering each country. When adopted by the ECOWAS and member states, the regional PRS will not only allow the participating countries to register the appliances being placed on the West African market, but to also share policy compliance intelligence with one another, enabling those with fewer resources to benefit from efforts of more active countries.

National efficiency policies for cooling appliances. To date, only 4 countries in the region have national efficiency policies for room ACs – Ghana, Nigeria, Benin and Guinea, and 4 countries policies for refrigerators – Ghana, Nigeria, Cape Verde and Guinea.

Ghana has the most advanced energy efficiency programme for cooling appliances in the ECOWAS region. It adopted policy room ACs in 2003 and added the policy for refrigerators in 2009. Ghana's energy efficiency programme requirements are mandatory, requiring all covered products, including room ACs and refrigerators, to meet the set performance levels prior to being sold in the country. Ghana has been focusing on building their national efficiency programme in order to protect their markets from low quality and inefficient appliances.

Nigeria has adopted the regional MEPS and labeling requirements for room ACs and refrigerators in 2018, which became mandatory a year later. In 2019, Benin has also adopted regional MEPS for room ACs and Guinea voluntary MEPS for both room ACs and the refrigerators. Cape Verde has mandatory MEPS only for refrigerating appliances, while Liberia and Burkina Faso are considering adopting ECOWAS regional polices for both appliances. Senegal and Burkina Faso are also planning to adopt the WAEMU Labeling Scheme for the two appliances.

Other seven ECOWAS members, - The Gambia, Sierra Leonne, Cote D'Ivoire, Guinee-Bissau, Togo, Niger and Mali, - do not have efficiency policies for cooling appliances and are not currently developing them. See Table A-1 for summary of the policy status in ECOWAS member states.

Efficiency Policy Compliance and Enforcement. Since policy adoption, Ghana has implemented various compliance mechanisms including mandatory product certification and registration with Ghana's Energy Commission prior product import to protect their appliances markets from inefficient products. Authorities in Ghana accept testing reports from third-party accredited laboratories and engage private companies such as SGS[31] to conduct pre-export verification of conformity of products prior to import. Ghana adopted a policy that requires verification[32] testing of suspicious products undergoing customs clearance to prevent non-compliant products from entering the country.[33] The Commission also conducts market monitoring and checking the appliances sold in the retail shops, testing suspicious appliances and enforcing corrective actions and stricter penalties when appropriate.

Nigeria has only recently adopted regional efficiency policies for the two cooling appliances and are in the process of setting up compliance mechanisms to enforce them. The regulation includes requirement for authorities to select products at customs, prior to entry to the country, for verification testing to prevent non-compliant products from entering Nigeria.

Based on CLASP survey and research in 2019, other countries with adopted regional efficiency policies have minimal or no processes in place to implement them and enforce compliance.

In depth case studies on Ghana and Nigeria are included in Appendix B and C, respectively, providing details on their efficiency programmes' development and enforcement.

Regional Testing Capacity for Cooling Appliances. As of 2020, there were three room AC and two refrigerator testing laboratories in operation or under-construction in ECOWAS region. Both Ghana and Nigeria are procuring the testing

29 Also known by French acronym UEMOA (Union Economique et Monétaire Ouest Africaine)
30 https://www.reeep.org/projects/ee-labelling-system-household-appliances-west-african-countries
31 https://www.sgs.com/en/public-sector/product-conformity-assessment-pca
32 Also referred to as check testing.
33 Internal communication with policymakers in Ghana.

laboratories for air conditioners and Cape Verde has unaccredited AC test laboratory. Ghana has an accredited refrigerator test laboratory and Nigeria is in the process of commissioning one.

Ghana utilizes well their refrigerator laboratory to test refrigerators selected at customs in order to check their claimed performance as per regulatory requirement, which minimizes the risk of delay for import. Nigeria, which is currently procuring AC and refrigerator laboratories, has a similar regulatory testing requirement, as well largest appliance markets in West Africa and local AC manufacturing base. Therefore, building laboratory capacity in Nigeria is justified, especially that the local manufacturing is likely expand to meet growing demand in Nigeria and the rest of Africa.

The other ECOWAS members have also been prioritizing building testing laboratories for cooling appliances, which they consider to be a barrier to implementing their national energy efficiency policies for appliances. Five other member states that have recently adopted or are in the process of adopting the efficiency policies for the two products are planning to build national testing laboratories (Table A-1). This may not be appropriate especially for the countries with small appliance markets and low efficiency programme budgets, because testing laboratories require large upfront investment and continuous funding for operation. Such investment should be carefully weighted and alternative solutions considered followed by building the business case for the laboratory to ensure the most effective and sustainable investment and utilization of limited resources.

TABLE A-1. ENERGY EFFICIENCY POLICY STATUS FOR ROOM AIR CONDITIONERS AND REFRIGERATORS IN ECOWAS REGION

ECOWAS Member State	WAEMU Member	Room AC			Refrigerator		
		MEPS	Labeling	Testing Lab	MEPS	Labeling	Testing Lab
Ghana	No	Adopted (2003, being revised)	Yes	Yes	Adopted (2009, being revised)	Yes	Yes
Nigeria	No	Adopted, regional (2017)	Yes	Yes	Adopted, regional (2017)	Yes	Yes
Cape Verde	No	Under development	Under development	Yes	Adopted	Yes	Planning
Benin	Yes	Adopted, regional (2019)	Yes	Planning	Under development	Under development	Planning
Guinea	No	Adopted, regional, voluntary (2019)	No	Planning	Adopted, regional, voluntary (2019)	No	Planning
Senegal	Yes	No	Planning (WAEMU Labeling Scheme)	No	No	Planning (WAEMU Labeling Scheme)	No
Liberia	No	Under development (regional)	Under development	Planning	Under development (regional)	Under development	Planning

ECOWAS Member State	WAEMU Member	Room AC			Refrigerator		
		MEPS	Labeling	Testing Lab	MEPS	Labeling	Testing Lab
Burkina Faso	Yes	Under consideration (regional)	Planning (WAEMU Labeling Scheme)	Planning	Under consideration (regional)	Planning (WAEMU Labeling Scheme)	Planning
Other Members*	-	No	No	No	No	No	No

* The Gambia, Sierra Leonne, Cote D'Ivoire, Guinea- Bissau, Togo, Niger and Mali, of which Cote D'Ivoire, Guinea- Bissau, Togo, Niger and Mali are WAEMU Members.

Appendix B: Energy Efficiency Programmes for Cooling Appliances in ECOWAS - A Case Study of Ghana

Current Status of the Market

The air conditioner (AC) and refrigerator markets in Ghana are import-based. From 2014 to March 2019, the country imported around 600,000 room ACs and 1 million refrigerators.[34,35] These cooling appliances are sold in brick-and-mortar stores and increasingly on online platforms. The market for second-hand appliances in Ghana used to be of considerable size until the country introduced a ban on the importation and sale of used refrigerators and ACs in 2008 and enforced this ban in 2013.[36]

Standards and Labeling Programs for Air Conditioners and Refrigerators

Ghana is the first country in sub-Saharan Africa to enact appliance energy efficiency regulations.[37] The Ghana Electrical Appliance Labelling and Standards Programme was launched in 1998 by the Ministry of Energy and the Ghana Standards Authority (GSA).[38] The mandatory minimum energy performance standards (MEPS) and labeling requirements for ACs and refrigerators came into effect in 2005 and 2009 respectively.[39] A timeline of the development of AC and refrigerator energy efficiency regulations in Ghana can be found in Table B-1. Examples of the energy labels for cooling appliances are shown in Figure B-1.

Figure B-1: Energy efficiency labels for ACs and refrigerators in Ghana

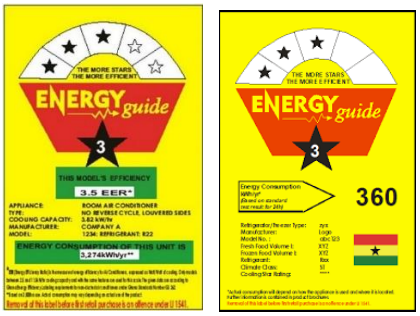


Table B-1: Historical overview of AC and refrigerator energy efficiency regulations in Ghana

Year	Event
1998	The Ghana Electrical Appliance Labelling and Standards Programme was launched.
2001	*The Ghana Standard (GS) 362: Non-Ducted Air Conditioners – Testing Rating for Performance, 2001* established the performance specifications and test procedure for non-ducted ACs. This standard was later replaced by GS 362:2018.[40]
2005	Legislative Instrument (L.I.) 1815 Energy Efficiency Standards and Labelling (Non-Ducted Air Conditioners and Self-Ballasted Fluorescent Lamps) Regulations was adopted. This

34 Information provided by Kofi Agyarko, Ghana Energy Commission
35 According to a market scoping study by CLASP in 2018, the Ghanaian AC market is dominated by big international brands, such as Samsung, NASCO, Midea, and LG: https://clasp.ngo/publications/scoping-study-of-african-air-conditioner-markets
36 L.I. 1932 Energy Efficiency (Prohibition of Manufacture, Sale or Importation of Incandescent Filament Lamp, Used Refrigerator, Used Refrigerator-Freezer, Used Freezer and Used Air Conditioners) Regulations: http://www.energycom.gov.gh/files/LI_1932.pdf
37 CLASP, Transforming the West African Market for Energy Efficiency: Ghana Leads the Way with Mandatory Standards and Labels: https://clasp.ngo/publications/transforming-the-west-african-market-for-energy-efficiency-ghana-leads-the-way-with-mandatory-standards-and-labels
38 The programme also received support from the Ghana Energy Foundation, CLASP, and the United Nations Department for Economic and Social Affairs. Its name was later changed to Ghana Appliance Energy Efficiency Standards and Labelling Programme.
39 In addition, the MEPS for self-ballasted fluorescent lamps was set in 2005.
40 Catalogue of Ghana Standards 2018: https://www.gsa.gov.gh/wp-content/uploads/2018/08/2018-Catalogue-of-Ghana-Standards.pdf

Year	Event
	document requires a non-ducted AC manufactured or imported for use in Ghana to have an energy efficiency ratio (EER) of 2.8 or higher and bear an energy efficiency label.
2007	*GS IEC 62552 Household Refrigerating Appliances – Characteristics and Test Methods, 2007* specified the performance specifications and test procedure for household refrigerators. This standard was later replaced by GS IEC 62552:2015.[41]
2008	L.I. 1932 Energy Efficiency (Prohibition of Manufacture, Sale or Importation of Incandescent Filament Lamp, Used Refrigerator, Used Refrigerator-Freezer, Used Freezer and Used Air Conditioners) Regulations was introduced. After importers and retailers were given a grace period to adjust their operation, this ban fully came into force in 2013. An amendment is being developed to ban the importation of used parts.
2009	L.I. 1958 Energy Efficiency Standards and Labelling (Household Refrigerating Appliances) Regulations was adopted. Under L.I. 1958 and its amendment L.I. 1970, a refrigerating appliance manufactured or imported for use in Ghana must have an energy efficiency index (EEI) of 90 or lower for sub-tropical and 100 or lower for tropical climate class. The appliance must also bear an energy efficiency label.

In 2010, the Ministry of Energy released the National Energy Policy, which establishes the policy directions for Ghana's energy efficiency policies and programs. In 2015, energy efficiency targets and policies were announced in the Ghana National Energy Efficiency Action Plan. According to this action plan, Ghana aims to have fifteen energy efficiency standards and labels in place by 2020, including three lighting standards and twelve appliance standards.[42] At the end of 2018, Ghana released its first Building Code, which establishes requirements and recommendations for energy efficiency standards for residential and non-residential buildings.[43]

The Energy Commission (EC) under the Ministry of Energy sets and implements energy efficiency standards and regulations in Ghana, while the Ghana Standards Authority (GSA) sets the testing standards and conducts appliance testing. The EC and the GSA work together to enforce energy efficiency policies for ACs and refrigerators. They collaborate with the Customs, Excise, and Preventive Service at market entry points to assess if imported appliances comply with the energy efficiency regulations.

Compliance Framework for Energy Efficiency Programme

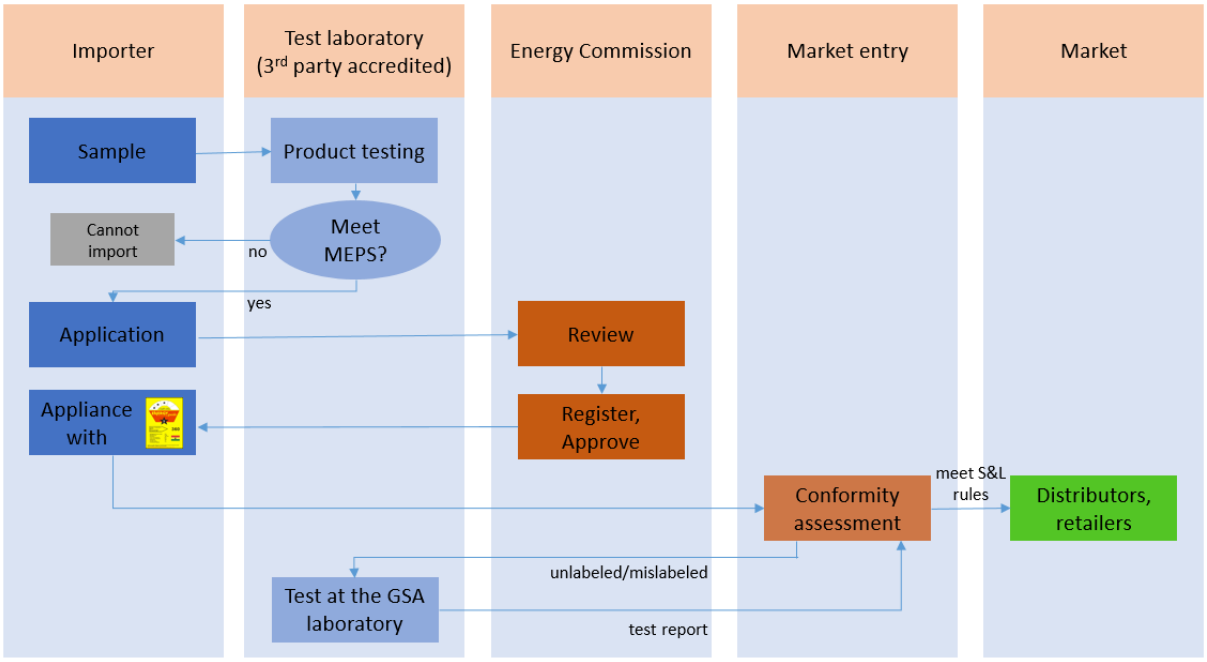
Appliance Registration and Certification[44]

Before importing and selling an AC or refrigerator in Ghana, an importer[45] must first register the appliance model (Figure A-2) by submitting an application, which includes a test report from a third-party accredited test laboratory. The electronic application should be submitted to an online portal and the hard copy sent to the Executive Secretary within the EC. The Inspectorate and Enforcement Directorate at the EC then reviews this application. If the model conforms to the MEPS, the directorate proceeds to enter the model into its product registry and issue a letter of approval to the importer. Once the importer receives the letter, it affixes the corresponding energy efficiency label on the appliance before importing it to Ghana.

At the ports of entry, the staff from the Inspection and Enforcement Directorate use the product registry to check if the imported appliances have been registered with the EC prior to importing. They also conduct physical inspection of the appliances, which includes checking the presence of labels, specifications, and label information accuracy. If the appliances and the labels are compliant, they are allowed to enter Ghana. If the labels are missing, or the energy efficiency information is perceived to be incorrect, the appliances are subject to testing at the GSA laboratory. Cooling appliances arriving in Ghana without prior registration, approval, or labels are not allowed to enter the country until these regulatory requirements are met. A summary of this process is illustrated in Figure B-2.

41 Ibid.
42 The appliance standards include refrigerators, ACs, washing machines, electric water heaters, fans, transformers, and others.
43 Ghana Building Code Unveiled: https://www.gsa.gov.gh/2018/11/ghana-building-code-unveiled/
44 Interview with Hubert Zan, Ghana Energy Commission
45 For simplicity, an importer means any entity that wishes to import appliances to Ghana, such as manufacturer, distributor, or retailer.

Figure B-2: Cooling appliances registration process in Ghana



The Inspection and Enforcement Directorate produces inspection reports that provide information on compliant and non-compliant appliances. The market surveillance team within this directorate then uses these data to inform market surveillance activities.

Market Surveillance[46]

Market surveillance activities are implemented by the EC in collaboration with the GSA, with the latter conducting appliance verification testing. Market inspections are conducted by a group of three people, two from the market surveillance team and one from the Energy Efficiency Policy Directorate within the EC. Since the majority of importers have operations and product warehouses in the Greater Accra region, market monitoring activities are conducted in this area on a monthly basis. The rest of the country is divided into four zones, each of which is surveyed once a year. This system allows the market inspection team to visit warehouses and shops throughout the country within the same year.

During each visit, the inspectors use a checklist to check if the appliances and the labels comply with the energy efficiency regulations. The checklist instructs the inspectors to check for labels, the information on the labels, and the submission of test reports, among other matters. The inspectors then enter the GPS location of every visited shop and its compliance status into a mobile application called Certified Appliances. Consumers can download this application to their phones to find where to buy efficient ACs, refrigerators, and freezers, check the efficiency ratings of these appliances, and report non-compliant cases.[47]

The online market for cooling appliances in Ghana has been growing over the past few years. At the moment, Ghana does not monitor the online market or require online retailers to display the energy efficiency labels on their websites. It is considering establishing such requirement in the future.

Enforcement[48]

If a non-compliant case is identified, the EC takes an appropriate enforcement measure to address it. If an inspected appliance does not bear an energy label or the inspectors suspect that the information on the label is incorrect, the model is sent to the GSA's test laboratory for verification testing. If the verification test shows that the appliance and its label are indeed correct and compliant, the EC pays the testing fee. If not, the importer has to pay the fee and relabel the

46 Interview with Hubert Zan, Ghana Energy Commission
47 Certified Appliances app: https://play.google.com/store/apps/details?id=com.sabonzy.refrigeratorappliance&hl=en_US
48 Interview with Francis Akpaloo, Ghana Standards Authority

model under the supervision of the EC and the GSA representatives.[49] In the case when the model performance does not meet the MEPS, it is removed from the market and may be destroyed or exported out of Ghana.[50] A risk of this enforcement measure is that the low-quality appliances might be sent to neighboring countries that have no or lower performance standards.

The penalty for a person who manufactures in Ghana or imports to Ghana cooling appliances that do not comply with the energy efficiency regulations is a fine of up to 250 penalty units (each penalty unit is equal to GH₵12, or USD 2 approximately) or an imprisonment term of up to twelve months or both.[51] If the non-compliant case is committed by a firm or a partnership, the group of people responsible for the offense may be subject to a higher penalty and additional compensation.

It is important to note that when the GSA started testing refrigerators and freezers in 2015, it found that only 10% of the tested appliances met the MEPS or showed the correct energy efficiency ratings. The GSA and the EC then organized several workshops for importers and other stakeholders to raise awareness of the energy efficiency requirements for cooling appliances. Thanks to this outreach effort, the GSA saw compliance rate increase to around 35% in the following year. In 2019, the compliance rate reached above 90%.[52]

Testing Laboratories

Test Laboratory for Refrigerators[53]

The GSA's Electrical and Electronics laboratory carries out testing for different appliances in Ghana, including performance testing for refrigerators and freezers. Five staff manage and operate this laboratory. The laboratory that conducts performance testing for refrigerators and freezers has been in operation since 2015 and is in the process of obtaining accreditation. It can test four refrigerators simultaneously or two freezers simultaneously. It takes about a week to test a refrigerator and two weeks to test a freezer.

The test laboratory mainly conducts verification testing of cooling appliances in support of Ghana's energy efficiency programs. In recent years, the rising level of compliance with the energy efficiency regulations has reduced the number of verification tests needed. Currently, the testing fee for a refrigerator is GH₵ 4,500 (USD 835), for a freezer is GH₵ 5,500 (USD 1,020). In addition to verification testing, the laboratory offers commercial testing services to third parties, such as manufacturers, importers, distributors, or retailers. The GSA is interested in providing its testing services for other countries' energy efficiency programs in the future.

Proposed Test Laboratory of Air Conditioners[54]

The GSA is in the process of establishing a test laboratory for ACs, which is expected to become operational in early 2020. It will be able to test ACs with capacities of up to 8kW[55]. The laboratory will carry out testing for the energy efficiency programs and commercial testing for other parties, if needed.

49 Notice to Importers of Appliances Covered Under Energy Efficiency Regulations: http://www.energycom.gov.gh/public-notices/77-notice-to-importers-of-appliances-covered-under-energy-efficiency-regulations
50 Interview with Hubert Zan, Ghana Energy Commission
51 L.I. 1958 Energy Efficiency Standards and Labelling (Household Refrigerating Appliances) Regulations: http://www.energycom.gov.gh/files/LI1958.pdf
52 Interview with Francis Akpaloo, Ghana Standards Authority
53 Ibid.
54 Ibid.
55 Discussions are in progress to update capacity to 12kW to meet labeling regulation requirements.

Appendix C: Energy Efficiency Programmes for Cooling Appliances in ECOWAS - A Case Study of Nigeria

Current Status of the Market

Nigeria is the most populous country in the ECOWAS region, with a population estimated to be 201 million people.[56] As a result, the size of the cooling appliances market in Nigeria is relatively high as compared to other West African countries. A study conducted by the Nigerian Energy Support Programme (NESP) reveals that in 2014, nearly 1.3 million air conditioners were imported into the Nigerian market while 679,800 units were manufactured locally.[57] The same study shows that 21 brands of new air conditioners and 26 brands of second-hand air conditioners were found in Nigeria. Similarly, during the 2012 national inventory[58], it was found that 905,646 refrigerators were imported into the Nigeria while 497,624 were manufactured locally.

Energy Efficiency Programs for Cooling Appliances

The Nigerian government began the process of developing MEPS for electrical appliances during the implementation of a UNDP/GEF-funded project, which was inaugurated in 2011. The project identified minimum energy performance standards (MEPS) for appliances as one of the strategies of promoting energy efficiency. The first MEPS ever developed in Nigeria was for compact fluorescent lamps (CFLs) and was approved by the Nigerian authority in 2013.

After the harmonization of AC and refrigerator MEPS in the ECOWAS region, which was approved by ECOWAS Council of Ministers, each country in the region was expected to domesticate the harmonized MEPS. The Nigerian government has since passed the ECOWAS MEPS through national process to become national regulations in Nigeria. The MEPS for refrigerators and air conditioners were approved in July 2017 and enforcement of the standard began in January 2018. Below are the titles of the MEPS for refrigerators and air conditioners respectively:

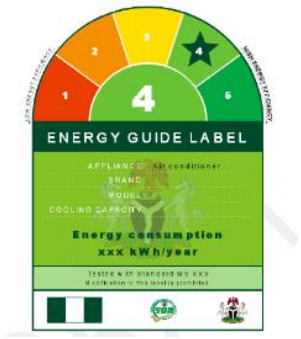
- NIS ECOSTAND 071-1:2017EE – Minimum Energy Performance Standards (MEPS) – Part 1: Refrigerating Appliances
- NIS ECOSTAND 071-2:2017EE – Minimum Energy Performance Standards (MEPS) – Part 2: Air Conditioning Products

The Standards Organisation of Nigeria (SON) is responsible for the development and implementation of the MEPS and energy labeling programs for appliances. The SON collaborates with the Nigerian Custom Service (NCS) to regulate imported appliances. The SON handles product registration and certification, while the NCS requires the certification from the SON to complete the clearing process for imported appliances. Appliances that are manufactured locally undergo a different program called Mandatory Conformity Assessment Programme (MANCAP) that is also operated by SON.

Through a market research conducted by the Energy Commission of Nigeria, the Nigeria government has adopted a 5-step energy class dial label (Figure C-1). The label has a clock shape or gauge and the greater efficiency is linked to clockwise advancement along the gauge. Energy labels must be placed on appliances before importing to Nigeria.

Figure C-1. Nigeria's energy efficiency label.

56 Punch Newspaper April 30, 2019. Nigeria's Population Now 201 Million – UN. https://punchng.com/nigerias-population-now-201-million-un/
57 NESP 2015. Baseline Assessment of Air Conditioners in Nigeria. A report of the Nigeria Energy Support Programme (Phase 1) of the GIZ, European Union and the Federal Ministry of Power. Editor: Jean Claude Foret and Olayinka Ohunakin.
58 Implemented under the Energy Efficiency Programme with support from UNDP/GEF.



Room ACs imported or manufactured in Nigeria must have an energy efficiency ratio (EER) of 2.8 or higher. Refrigerators imported or manufactured in Nigeria must have an energy efficiency index (EEI) of 80 or lower for sub-tropical and tropical climate class. The detailed standards can be found in able C-1 below.

Table C-1. MEPS and star-rating levels for room ACs and refrigerators.

Star Levels	EER for Air Conditioners	EEI for Refrigerators	
		Climate Class ST	Climate Class T
5-Star (Most Efficient)	5.00≤EER	EEI<30	EEI<40
4-Star	4.20≤EER<5.00	30≤EEI<42	40≤EEI<55
3-Star	3.60≤EER<4.20	42≤EEI<55	55≤EEI<65
2-Star	3.20≤EER<3.60	55≤EEI<65	65≤EEI<75
1-Star (Least Efficient)	2.80≤EER< 3.20	65≤EEI<80	75≤EEI<80

One of the major challenges of the energy efficiency programmes for cooling appliances in Nigeria is sensitizing the importers and the public on the newly approved MEPS and labeling scheme. The government is expected to receive support from the Nigeria Energy Support Programme of the GIZ and EU to create awareness on the standards and labelling scheme for refrigerators and air conditioners.

Compliance Framework for Energy Efficiency Programme

Conformity Assessment

Standard Organization of Nigeria Conformity Assessment Programme (SONCAP)
The SON establishes the Standard Organization of Nigeria Conformity Assessment Programme (SONCAP), which is an off-shore certification system that tests and certifies appliances in accordance with Nigerian standards before they are imported into Nigeria. The SON has identified global firms known as International Accredited Firm (IAF) to help test appliances coming from different parts of the world to the Nigerian market. These IAFs have global coverage and may have laboratory of their own or rely on other accredited laboratories to carry out appliance testing. Importers intending to bring appliances into Nigeria need to send the appliances to any of these IAFs, who will conduct the test of the appliances and send the test results to the SON. Subsequently, the SON will then issue the SONCAP certification if the appliance complies with national standards. Depending on the types of certification, the fees that the SON charges range from $300 to $1,300 per certificate.[59] Importers than use the certificates from the SON for the customs clearance process.
Interagency collaboration in conformity assessment: The NCS plays a pivotal role in the conformity assessment process. It operates and hosts an online platform called the Nigeria Integrated Custom Information System (NICIS), which the

59 For more information about SONCAP, please see https://son.gov.ng/soncap_service.

SON is given access to. Among other functions such as trade facilitation and tariff processing, the NICIS facilitates the conformity assessment process. The NCS requires the SONCAP certificate as a requirement before appliances are allowed into the country. This certificate is sent directly to the Customs. When the appliances arrive at the port of entry, customs officers will call for the SON officials to carry out physical inspection of the appliances.

Mandatory Conformity Assessment Programme (MANCAP)
The MANCAP is a mandatory product certification scheme put in place by SON in 2006 to ensure that all locally manufactured appliances in the country conform to the relevant standard before they are presented for sale in the market or exported. The Product Certification Department (PCD) of the SON is responsible for carrying out this statutory function and issuing the MAN CAP certificate. The MAN CAP certification is valid for 3 years. The service fees charged by SON to acquire the MAN CAP certificate depends on the size of the factory and could be up to N195,000 ($542) per annum.

The procedures for MANCAP certification involve the following:[60]

- First, the staff of SON visit the company premises and carry out the inspection of the production processes of the appliances;
- Samples of the appliance are collected and tested against the relevant Nigerian Industrial Standards (NIS) to confirm compliance;
- Report of inspections and test results are compiled by State Offices of the SON and forwarded to the PCD of SON for evaluation. PCD then makes recommendation to the Management of SON for approval and certification;
- If the appliance meets the requirement of the relevant NIS, MANCAP certificate and MANCAP logo which bears a unique number are issued for the appliance upon payment of applicable administrative charges.

Product registration: Product registration is one of the schemes of the SON to ensure traceability and safeguard against the influx of substandard appliances into Nigeria. New appliances are required to register with SON prior to being sold in the market. The registration involves subjecting the appliance to the required test procedures and if the results conform with the existing standard, the appliance is then certified by the SON. There is a product registration department domiciled in the SON, mandated to carry out this function. The department has a product registration database, which is a catalogue of products that undergo registration with the SON. Registration fees depend on the volume, capacity, size, and other characteristics of the appliance. The fees can be paid online.

Product database: The SON initiated a process to develop a product database sometimes ago, but the process has since been suspended.

Second-hand appliance market: There is a ban on the importation of secondhand air conditioners and refrigerators since 2001, thus, the secondhand market is not regulated.

Market Surveillance[61]

There is a directorate in the SON committed to carrying out market surveillance activities. The SON has offices in the 36 states of Nigeria including the Federal Capital Territory. Surveillance activities are carried out daily in these offices. Surveillance is done manually and randomly; the SON staff sometimes stop the trucks that transport these appliances and inspect their containers. They also purchase appliances randomly from shops and take them to the laboratory for test. In cases where they receive distress information from the public on potential substandard appliances, they are empowered by law to seal up the shop or warehouse to enable them conduct test to assess compliance to national standards.

Verification testing for safety is carried out by the SON using their laboratory laboratories. Verification testing is a statutory and regulatory duty of the SON and for this reason, importers do not pay for the testing of their appliances. However, importers are required to pay a service charge of N3,500 ($9.7) per container. The number of samples required to carry out test for any appliance is stated in the standard for that appliance.

Enforcement

60 This activity currently focuses on appliance quality and safety, as the laboratories for energy efficiency have not operated yet. Requirements regarding appliance energy efficiency will be added in the future.
61 This activity currently focuses on appliance quality and safety, as the laboratories for energy efficiency have not operated yet. Market surveillance for appliance energy efficiency will be added in the future.

The penalties for non-compliance are stated in the Standards Organisation of Nigeria Act, 2015, and such penalties are decided by a court of competent jurisdiction. The penalties could be prosecution, payment of fine, or destruction of goods. In some cases, the manufacturer or importer may be asked to correct the defect in the appliance.

Testing Laboratories for Cooling Appliances

The main purpose for establishing testing laboratories is to carry out verification testing for market surveillance. With support from the GEF and the UNDP, the SON installed the test laboratory for refrigerators and freezers through the services of a company in the United States called TESCOR. However, the laboratory is yet to be commissioned. TESCOR was expected to send their personnel to Nigeria to commission the facility. The test laboratory was built with the sum of $361,250, which includes the cost of training and commissioning. SON is still expecting personnel from TESCOR to commission the equipment. The refrigerator testing chamber can test 6 refrigerators simultaneously.

The procurement process to purchase the AC testing equipment is on-going and is expected to become operational by 2020.[62] Both laboratory laboratories will be solely under the SON. The process to get accreditation for all the laboratories of SON is on-going.

A minimum of four (4) technical staff are needed to operate any of the testing laboratories. Beside the cost of electricity for running the laboratory, the cost of servicing these staff is estimated to be N600,000 ($1,669) per month. The law mandates SON to charge fee to carry out testing of appliances for conformity. However, due to the policy of government on the ease of doing business in Nigeria, SON is currently not charging any cost for verification testing of appliance when conducting its regulatory function. The fund to conduct verification testing is mainly coming from the government. A working customer who wants to conduct testing of AC and refrigerator for conformity will require to pay the sum of N90,000 ($250) per test.

62 This is being supported under Phase 2 of the Nigerian Energy Support Programme funded by the GIZ and the European Union.

Appendix D: List of Acronyms

AC	Air Conditioner
ECOWAS	Economic Community of West African States
ECREEE	ECOWAS Centre for Renewable Energy and Energy Efficiency
MEPS	Minimum Energy Performance Standards
PRS	Product Registration System
WAEMU	West African Economic and Monetary Union

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CLASP 1401 K Street NW Suite 1100 Washington DC 20005 USA +1 202 750 5600 info@clasp.ngo clasp.ngo