Assessing testing capacity in ECOWAS and ASEAN regions to support S&L programs for cooling appliances

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Abstract

Reliable test procedures and test facilities that provide consistent and accurate results are the foundation of successful standards and labelling (S&L) programs for cooling appliance energy efficiency. Testing guarantees the quality and efficacy of products and enables governments and other stakeholders to accurately verify product performance, helping safeguard their S&L programs' estimated energy and emissions savings.

Ensuring adequate testing capacity is necessary for the establishment of any S&L program. Increasingly, policymakers are prioritizing building national or government-owned testing laboratories in support of new S&L programs. However, this requires significant investment, e.g. the cost to build a laboratory to test room air conditioners can exceed USD 1 million (EUR 873,700), which does not include the continuous funding required to maintain and operate the facility and support its staff. In fact, the actual need for and sustainability of laboratory operations is often overlooked, which can lead to underutilization of newly established facilities. Alternative solutions such as outsourcing testing needs to private or foreign test laboratories are often considered less attractive, even though they may be more cost-effective and enable greater focus on market surveillance efforts.

Under the Kigali Cooling Efficiency Program, CLASP is assessing testing needs and capacities for cooling appliances in the Economic Community of West African States (ECOWAS) and the Association of Southeast Asian Nations (ASEAN) to facilitate implementation of regionally aligned standards. This paper provides an overview of current efforts and challenges for developing S&L program capacity to test cooling products for energy efficiency at regional and national levels. We argue that a decision to build a national testing facility should be based on a strong business case and consider cost-effective alternatives to extensive testing for market surveillance.

Introduction

Air conditioning makes up a significant portion of household energy demand, particularly in regions with hot climates. Cooling product markets are growing around the world as, for the first time, millions of households have the financial means to control their indoor climate, especially in developing and emerging economies from Vietnam to Nigeria to Brazil. An estimated 700 million new room air conditioners (ACs) will be installed by 2030 and 1.6 billion by 2050 (Shah et al., 2015). Energy efficiency policies for cooling appliances have the potential to reduce electricity consumption, thereby helping to mitigate impacts of climate change, reduce energy costs for consumers, and transform markets to more efficient products. According to a recent CLASP analysis, transitioning to energy-efficient room ACs in 150 countries would cut 620 TWh of electricity and 480 MT of carbon dioxide (CO_2) annually in 2030, saving consumers EUR 48.9 billion on their electricity bills (U4E, 2016).

Countries around the world have been setting minimum energy performance standards (MEPS) and implementing standards and labelling (S&L) programs for cooling appliances, which are the most impactful national mechanisms to reduce electricity consumption and CO_2 emissions (EES, 2014). In 2013, cooling appliances – specifically air conditioners and refrigerators

– were the most commonly covered products by S&L programs (EES, 2014). A total of 73 countries had standard and labelling programs for air conditioners and 75 for refrigerators, the number of which has increased since 2013 (EES, 2014). Some programs have successfully transformed their markets to more energy efficient and higher-quality products. For instance, India's program revised the star rating for the room AC label five times in the last ten years to respond to changes and innovations in the market (CLASP India, 2018). Markets with S&L programs are further protected by robust, cost-effective compliance frameworks, which ensure that low-quality, inefficient products that do not meet national standards are prevented from entering the market or removed from the market.

Building a successful cooling appliance S&L program can be a complex process for governments, especially when deciding where to allocate limited resources and how to safeguard anticipated program benefits. Designing an appropriate compliance regime in parallel to developing the S&L program can help reduce the occurrence of non-compliant products on the market early on. Market surveillance activities help identify potentially non-compliant products. These products are then tested to verify product performance claims, through verification testing, thereby protecting the integrity of the S&L program. Where possible, verification testing is conducted at a national testing facility to reduce shipping and customs costs and complications.

For new or developing programs in countries without national testing facilities, policymakers are increasingly considering building a national facility as an S&L program priority. A national government-owned test laboratory is often considered a critical component of an S&L program, as well as a source of national pride, and a deterrent to non-compliance.[1] However, establishing a national testing laboratory for cooling appliances requires a large investment and continuous funding to cover operational costs. Prior to building a testing facility, policymakers should, therefore, assess available funding sources for sustainable laboratory operation, because a laboratory may not generate sufficient income from testing services to "pay for itself". When the demand for market surveillance verification testing is small, and if the laboratory does not provide commercial testing, the underutilization of a facility can result in operational costs surpassing the income generated from testing services. When program funds are used to keep the laboratory operational and competent, compliance efforts are hindered, as these funds are diverted from other activities such as cost-effective market inspections or communications campaigns. Therefore, an initial business case assessment of the costs of building and operating a laboratory as well as the income or payback from projected demand for testing can help policymakers make a well-informed decision on the potential sustainability and value of investment for a national testing facility.

Alternative cost-effective solutions such as mutual recognition agreements (MRAs) or competitive tenders for product testing to other accredited third-party testing laboratories can also support testing needs under the national compliance program. Regional collaboration can further support and inform national compliance programs though information sharing, use of collaborative platforms, joint testing programs, and regional product databases. Alternative solutions may reduce the need to conduct product verification testing[2] within the country, thus reducing the required budget for verification testing that is usually allocated by the government.

CLASP has been working with policymakers around the world to implement effective S&L programs and transform markets towards energy efficient, low global warming potential appliances. As a partner of the Kigali Cooling Efficiency Program (K-CEP), CLASP is currently assessing testing capacity and needs for cooling appliances in two important regions – the Economic Community of West African States (ECOWAS) and the Association of Southeast Asian Nations (ASEAN), to facilitate the implementation of regionally aligned standards. CLASP is providing guidance for countries in these regions on how to build adequate and sustainable testing capacity for national S&L programs.[3] K-CEP is a philanthropic initiative to support the Kigali Amendment of the Montreal Protocol and focuses on improving the energy efficiency of cooling to increase and accelerate the climate and development benefits of the Kigali Amendment to phase down hydrofluorocarbons (HFCs).

This paper provides an overview of the current status of testing capacity in the ECOWAS and ASEAN regions. It discusses best practices for building national and regional testing capacity and demonstrates that the decision to build a national testing facility should be based on a strong business case, taking into consideration alternative cost-effective approaches to support the testing needs of S&L programs and guarantee greater investment in market surveillance efforts.

Role of testing for successful S&L implementation

S&L policies provide a competitive advantage to products with higher energy performance – they may also incentivise some manufacturers or importers to make false declarations about product performance. To protect the credibility of S&L programs and maintain consumer confidence, policymakers must ensure that products meet minimum performance and labelling criteria. An effective compliance framework minimizes the risk of false and inaccurate declarations of product energy performance (CLASP, 2005).

Product testing is fundamental to creating and implementing voluntary or mandatory S&L programs, which require a high level of confidence that products perform as claimed. Mandatory programs require all products on the market to meet the MEPS for efficiency performance. A number of countries around the world, including the European Union (EU), Ghana, the Philippines, Singapore, and Thailand have mandatory MEPS for air conditioners and refrigerators (EES, 2014). Testing helps guarantee the quality and efficacy of products and provides the evidence needed to demonstrate compliance with national or regional standards – ultimately supporting the transition to cleaner, more efficient, and higher quality products.

1. Based on internal communication with the policymakers in different countries.

2. Verification testing is used to determine if a product that is selected by the compliance authorities performs according to its claimed energy performance value. Testing is usually conducted by accredited testing laboratories.

3. For more information see CLASP's e-magazine *Cooling in a Warming World: Global Markets & Policy Trends*. https://clasp.ngo/updates/2019/clasp-launches-cooling-in-a-warming-world.

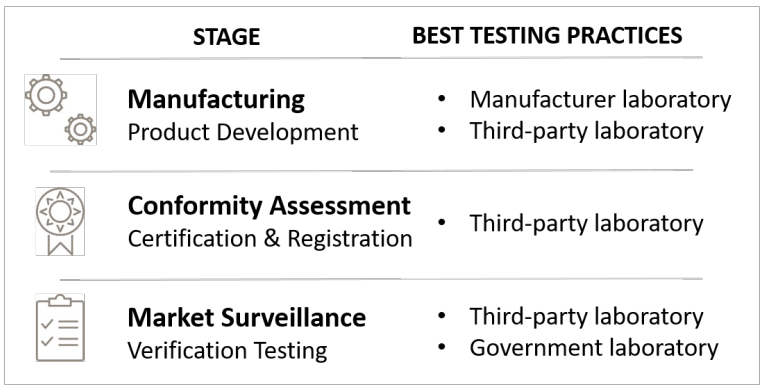

Figure 1. Testing at three stages.

Product performance testing can occur at three different stages of ensuring product quality and performance (Figure 1[4]). First, manufacturers test their products throughout the technology development phase to improve the product and ensure that it meets design specifications. A reliable, accredited testing facility accessible to manufacturers ensures they can meet or exceed S&L program requirements.

Testing is also a vital component of a country's compliance framework, as testing verifies that products meet performance requirements and facilitates enforcement actions where needed. At the second stage of the testing process, during conformity assessment, recommended practice is for regulators to require manufacturers to provide test reports from accredited and preferably third-party laboratories for product certification and registration. This requirement provides greater confidence in product compliance with regulatory criteria – thereby preventing non-compliant products from entering the market. (IFIA, 2018.) Such conformity assessment schemes are implemented in Thailand, Singapore and Mexico.[5] Some S&L programs allow manufacturers and importers to self-declare the conformity of products with the performance requirements, as in the EU. This approach may result in more non-compliant products in the market. A survey conducted by International Federation of Inspection Agencies (IFIA) on compliance with safety regulations found that for the S&L programs that permit self-declaration of conformity 17 % of products had safety-critical failures (mostly in the EU), but less than 1 % of products had safety-critical failures when the S&L programs required a third-party conformity assessment (IFIA, 2018). A less stringent conformity assessment approach delivers a lower level of confidence and compliance, thereby requiring increased government funding for market surveillance to minimize cases of non-compliance.

The third stage of testing, verification testing during the market surveillance process, is conducted on products selected during market inspections to verify the product's claimed performance. Verification testing provides the proof regulators need in order to confirm that a product is non-compliant and take suitable enforcement action, such as requiring the supplier to remove the product from the market. Product testing at this stage can be conducted at private test laboratories, as well as government-owned laboratories. However, policymakers might prioritize building their own national testing facility due to potential challenges, such as shipping and customs, which may arise with testing products at a foreign or third-party laboratory.

The focus of this paper is on verification testing for market surveillance, as this is where regulators in new or developing programs often consider a government owned laboratory most necessary.

The challenge

Prioritization of national testing facilities to support market surveillance activities is usually grounded in a perceived need and not a business case. Policymakers often conflate the need for testing with the need to build a national testing facility.[6] This can lead to delays and threaten program credibility, especially for newly implemented S&L programs, as governments may believe it is not possible to enforce their programs without a national government-run laboratory. Even though other solutions are available for outsourcing testing needs, policymakers often do not see them as viable alternatives.[7] Prior to building a new testing laboratory, policymakers do not always assess their own testing needs, nor potential business from other countries, to ensure that a laboratory will have a sufficient income stream for sustainable operation. Deficient and hard to access data on the costs of building a laboratory and conducting testing can also make determining the business case for a national testing laboratory challenging.

The common assumption is that a national laboratory will "pay for itself", which is not always the case. Establishing a national testing laboratory for cooling appliances requires a large upfront investment and often ongoing funding. A laboratory may not generate sufficient income to cover their ongoing operational costs, especially if the laboratory's only client is the government's market surveillance verification testing program. If there is little demand for product testing from the market surveillance program, the underutilization of a facility may hinder other compliance efforts, as the funds needed for laboratory upkeep and maintenance may be diverted from other

4. These are most commonly observed practices. The regulator may require to test products at a government laboratory as part of conformity assessment for product certification and/or registration. Similarly, under the Supplier's declaration of Conformity the manufacturer may be allowed to test their products at their own laboratory.

5. Internal communication with policymakers.

6. From internal communication with policymakers from different countries.

7. From internal communication with policymakers from APEC countries.

Table 1. Indicative costs of building and operating a room AC laboratory[i] (SEAD, 2019).

	Low Estimate (EUR)	High Estimate (EUR)	Description
Capital Costs			
Product-specific equipment *(calorimeter room method)*	€305,100	€566,600	Room calorimeter, control air space chamber, compressor condensing units, air handling unit, humidifiers, pressure equivalence devices, water calibration system, air sampler and psychrometer box.
Generic equipment	€2,615	€4,360	Voltage stabilizer, thermometer, hygrometer, sampler, etc.
Accreditation	€4,360		To ISO 17025
Inter-laboratory trials	€4,360		For calibrating proficiency
Operational Costs			
Staffing	2 people		Minimum number of trained technicians
Equipment calibration and maintenance	€8,720		Estimated annual cost
Capacity building, staff training, laboratory re-certification, others	€1,740		Estimated annual cost

[i] *Notes: capital costs – equipment costs does not reflect applicable import tariffs or local taxes; installation costs by experienced technician. Operational costs: staff requirement does not include staff and responsibilities for administration and management functions; assumed existing space with reliable supply of electricity; equipment calibration costs are annualized.*

compliance activities, such as cost-effective market inspections or communications campaigns.

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 testing facility. 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 testing facility for cooling products.

CLASP is developing a tool that can help the policymakers to make better-informed decision on whether investing in national testing facility is as cost-effective as alternative options.

COSTS OF BUILDING AND OPERATING A COOLING TESTING LABORATORY

Setting up a laboratory is an involved, complex process requiring a large up-front investment for construction, procurement of specialized equipment, and building human capacity. A recent study conducted by CLASP for the Super-Efficient Equipment and Appliance Deployment (SEAD) Initiative found that the cost of setting up an AC or refrigerator testing laboratory can exceed EUR 550,000 (SEAD, 2019). Table 1 summarizes findings from the study showing the distribution of indicative values, which may vary based on product, test method, region, supply, and other factors (SEAD, 2019). Testing laboratory set up is usually funded by the government program or an international donor. For example, in Ghana, the testing laboratory for refrigerating appliances was funded by a UNDP/GEF project,[8] and in Sweden, the Swedish Energy Agency invested in equipment and staff competency to enable full energy efficiency testing of appliances (SEAD, 2019).

Prior to building a national laboratory, policymakers should assess what the required annual budget will be to maintain a competent laboratory including staff retention and training, equipment calibration, and accreditation costs, which can exceed tens of thousands of euros. Table 1 provides some indicative information on the costs of building and operating a room AC laboratory, which are based on interviews and surveys conducted with existing unaccredited and accredited government and private laboratories around the world.

The same study found that that the costs of building and operating a testing laboratory are relatively consistent across the regions (SEAD, 2019). Greater variation among the regions may be found for the costs to retain staff and space, such as lease or rent.

PRICES FOR TESTING COOLING PRODUCTS

Prices to test cooling products can vary greatly depending on different factors such as product type, test method, and region. Prices also increase for testing products at accredited laboratories. CLASP's study for the SEAD Initiative collected testing price data from national and private laboratories. Indicative prices to test room ACs (split and window type) at an accredited laboratory range from EUR 305 in a national laboratory in Asia, to EUR 9,667 at a private-sector laboratory in the EU. The prices are not necessarily comparable as they were collected during interviews with both accredited and non-accredited laboratories. Table 2 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 (SEAD, 2019).

8. 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/Susdevcluster-projects/.

Table 2. Indicative prices for testing a single room AC[ii] (SEAD, 2019).

Region	Applicable or Reference International Test Standard(s)	Source	Price (EUR per product)
Africa	ANSI/AHRI 1230-2010 EN 12102	N/A	N/A
Asia	ISO 5151: 2010 ISO 15042: 2011 ISO 16358 ISO 5151: 2010	Test Labs	€305–€5,943
MENA[iii]	EU 206-2012 ISO 5151: 2010 BS EN 14825- 2016	Test Labs	€906–€7,016
Latin America	NOM-026-ENER ISO 5151: 2010 Various national standards	Test Labs	€392–€2,926
Other Regions	ANSI/AHRI 1230-2010 ISO 5151:1994 EN 12102:2013 EU 626/2011	Test Labs Policy documents	€4,122–€9,667

[ii] *Notes: capital costs – equipment costs does not reflect applicable import tariffs or local taxes; installation costs by experienced technician. Operational costs: staff requirement does not include staff and responsibilities for administration and management functions; assumed existing space with reliable supply of electricity; equipment calibration costs are annualized.*

[iii] *Middle East and North Africa.*

As part of the national conformity assessment program, regulators usually require manufacturers or importers to bear the costs associated with testing products to prove compliance prior to product registration and certification in order to place them on the market. A common requirement, which is also a recommended best practice, is for manufacturers or importers to submit test reports issued by third-party accredited laboratories, but some countries require product testing at their national laboratories prior to placing them on the market. In the Philippines, the regulatory requirement under the Philippine Energy Standards and Labeling Program, which has since been changed, was to test all air conditioners at the national laboratory prior to placing them on the market (DOE, 2016). The backlog of products waiting to undergo testing caused delays of several months or more for the products to get onto the market.[9] Such requirements place immense burden on manufacturers and cause product sales losses. Additionally, if manufacturers sell their products in many different markets and are required to test their products to the same standards at the national laboratories in each country, they would bear a significant cost of testing. From the manufacturer perspective, such requirements are not cost-effective in small import markets where the revenue from sales can be relatively low. These inefficiencies can also spill over to consumers, who may pay higher prices for products or not be able to access certain products at all.

The costs of testing products that are suspected to be non-compliant, and thus selected during market surveillance for verification testing, are commonly covered by the government's compliance program budget. For example, Australia[10] and Singapore cover the verification testing of cooling products under market surveillance from their compliance program budget (CLASP, 2018b). In some countries, manufacturers and importers pay for verification testing of their products if authorities select them during market inspections. In the Philippines, the proposed Monitoring, Verification and Enforcement guidelines under the Philippine Energy Standards and Labeling Program requires manufactures or importers to cover the cost to transport and test product samples selected during market surveillance (DOE, 2016). Similarly, in Thailand, the Electricity Generating Authority of Thailand requires suppliers to cover the cost of purchasing the products selected as potentially non-compliant (CLASP, 2018b).

The goal of a market surveillance program is to minimize the number of non-compliant products on the market by monitoring as many products on the market as possible. When working with a limited budget, it is not recommended to test as many products as possible because testing products is expensive, but rather to target those products at high-risk of non-compliance. It is also important to consider the most cost-effective approach to test those select products. This way the benefits of market surveillance programs can be maximized, freeing funds for other cost-effective but impactful activities, including market labelling inspections.

Because national laboratories require large up-front investment and continuous finding to cover operational costs, policymakers should assess testing and funding needs prior to building a testing laboratory. If laboratory operating costs are higher than income from verification testing and commercial testing (if any), continuous government funding might be required to sustain operation and competency of the national testing facility. Considering cost-effective alternatives such as testing at third-party testing laboratories and establishing MRAs, both of which are discussed further in this paper, can help policymakers determine the best approach to conduct testing for national S&L programs.

9. Internal communication with policymakers in the Philippines.

10. Internal communication with the policymakers in Australia.

Current testing capacity in West Africa and Southeast Asia

The ECOWAS and ASEAN regions have developed regional standards for cooling products that have been adopted by some Member States, few of which have compliance programs to support their S&L programs and safeguard the anticipated energy and cost savings and emissions reductions. Under the K-CEP project, CLASP is evaluating current ECOWAS and ASEAN capacity to test cooling products for energy efficiency, opportunities to enhance their capacities, and cost-effective alternatives to extensive testing for compliance programs. This will enable governments to better evaluate where and how to test products, and make better-informed decisions about how best to allocate their limited resources. This, in turn, can help Member States accelerate implementation and enforcement of regional cooling standards and encourage the uptake of high-efficiency, low global warming potential space cooling appliances.

CASE STUDY OF THE ECOWAS REGION

Regional S&L program harmonization efforts are 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 standards and free-up 2,000 MW of power generation capacity by 2020 as stated in the *ECOWAS Energy Efficiency Policy* (EEEP) (ECREEE, 2012). ECREEE has already initiated and developed several regional MEPS, including MEPS for room ACs and refrigerators (ECREEE, 2018). However, adoption and implementation of these standards at the national level is challenging, as regional standards in ECOWAS are not subject to regional level legislation requiring their adoption by Member States. 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 (ECREEE, 2018). 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 Member States to adopt and implement regional appliance MEPS at the national level and set up their compliance programs. The Member States are prioritizing building testing capacity, which they consider to be a barrier in developing their national S&L programs, thus, taking away funding from other effective compliance efforts. This case study discusses the current testing needs and capacity in the region, and considerations for building adequate testing capacity under regional harmonization efforts.

ECOWAS is an important region in Africa encompassing 15 Member States.[11] However, the regional room AC market is relatively small, estimated at about 600,000 units in 2017, with the largest room AC markets shares in Nigeria and Ghana (JRAIA, 2018). 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 AC products, which mainly come through ports in Nigeria and Ghana.

Nigeria and Ghana are focused on building their national S&L programs for cooling appliances, which are the most advanced in the region, in order to protect their markets from low quality and inefficient products. Ghana established their S&L program for room ACs in 2003 and added refrigerators in 2009. Nigeria has adopted the regional MEPS and will begin enforcement in 2019.

Ghana's S&L program is mandatory, requiring all covered products, including room ACs, to meet the set performance levels prior to being sold in the country. Authorities in Ghana accept testing reports from third-party accredited laboratories and engage private companies such as SGS to conduct pre-export verification of conformity of products prior to market entry. Ghana adopted a policy that requires check testing of products when they go through customs to prevent non-compliant products from entering the country.[12] Therefore, Ghana needs a national laboratory to check the claimed performance of products selected prior to market entry and minimize the risk of delay to bring products onto the market.

Similarly, Nigeria is setting up a national laboratory, because Lagos Port is a major port in the region through which ACs are imported and also exported to other countries. Moreover, the local AC manufacturing base in Nigeria, spurred by foreign investment, will likely expand to meet growing demand in Nigeria and the rest of Africa (CLASP, 2018a). Under Nigeria's compliance program, authorities are required to select products at customs, prior to market entry, for check testing to prevent non-compliant products from entering the market. Thus, currently Ghana and Nigeria are in the process of building the first testing laboratories for room ACs in the region, as part of their national S&L programs (Figure 2).

Because nearly all ECOWAS Member States import AC products, building fully functioning AC testing laboratories in each of the 15 countries is not justifiable for those countries with smaller AC markets and no existing local manufacturing. Rather, authorities in each country should focus on product compliance checks and information sharing with their neighbours prior to allowing imported products onto the market. Accepting testing results from other countries in the region can minimize the burden of national compliance efforts and reduce resource requirements for market inspections and product verification testing. Moreover, strengthening conformity assessment programs and processes at the major product import points in the region would translate to less effort and resources needed for market surveillance and enforcement in each Member State.

Implementation of an effective S&L program at the regional level can only happen if all Member States actively participate and collaborate in preventing low quality non-compliant products from entering the regional market. In order to accelerate the adoption of harmonized MEPS for ACs and other products, ECREEE seeks to build the necessary infrastructure for successful program implementation, including adequate testing capacity in the region. Under the regional program, two reference laboratories that are considered at the regional level will

11. Benin, Burkina Faso, Côte d'Ivoire, the Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, and Togo.

12. Internal communication with policymakers in Ghana.

be important in combating imports of non-compliant products and support market surveillance efforts (ECREEE, 2018). *The Roadmap* provides a plan for building testing capacity, which should carefully consider current and future needs.

The Roadmap suggests several options for expansion of testing capacity in the region:

- Establishing regional laboratories to serve as reference laboratories with state-of-the-art technology to deliver accredited and more complex testing than national laboratories.
- Building testing capacity based on language considerations: French- vs. English-speaking countries.
- Building testing facilities based on geographical considerations.

The decision to build two regional reference testing centres has not been based on a needs assessment and no business case has been developed as yet, which might lead to underutilization of these newly established facilities. Developing a business case to build testing capacity in the region would ensure that adequate and sustainable capacity is developed, taking into consideration cost-effective alternatives to new testing facilities for cooling appliances. ECREEE, in partnership with CLASP, is currently developing a regional product registration database, which can also support sharing of verification test results to support national market surveillance efforts.

Demand for ACs in sub-Saharan Africa is expected to grow, contributing to a projected four-fold increase in electricity demand in 2040, as compared to 2010 (Castellano et al., 2015). The need for verification testing for market surveillance might be affected by such change, which may also lead to establishment of private laboratories in the region.

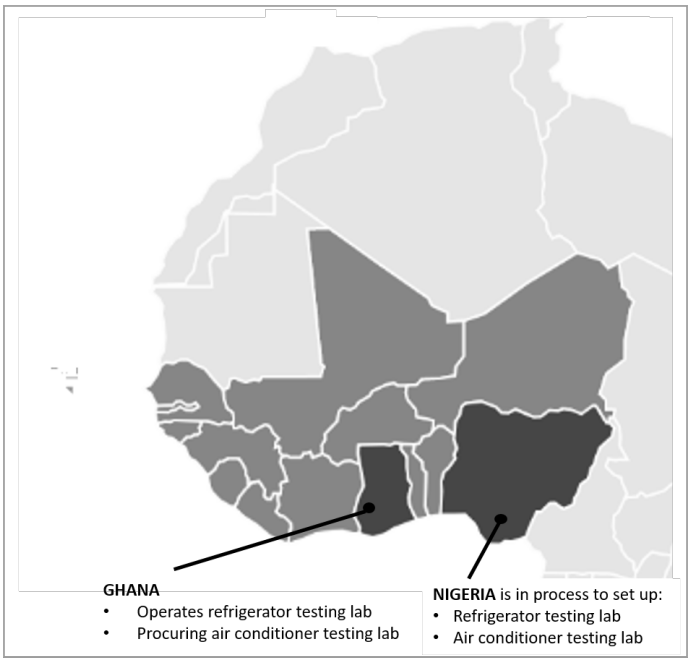

Figure 2. Map of national testing laboratories in ECOWAS for cooling appliances.

CASE STUDY OF THE ASEAN REGION

In the ASEAN region[13] harmonization efforts and national S&L programs are more advanced than in ECOWAS. To date, over half of ASEAN Member States have adopted MEPS for room ACs, the stringency of which varies among the countries. Some operate effective national compliance programs and have built testing capacity to support their S&L testing needs, while others have yet to develop S&L or compliance programs. This case study aims to provide an overview of testing needs and capacity in the ASEAN region, share examples from several countries, and discuss the approaches considered at the regional level for building adequate testing capacity in ASEAN.

Initial regional harmonization efforts in ASEAN began in 2013 with the launch of the ASEAN Standardization Harmonization Initiative for Energy Efficiency (ASEAN SHINE), in response to increasing electricity consumption for space cooling in the region. The initiative aims to increase the market share of higher efficiency ACs through harmonization of test methods and energy efficiency standards, including adoption of common MEPS. In 2015, ASEAN SHINE published the *Promotion of High Efficiency Air Conditioners in ASEAN: A Regional Policy Roadmap (Regional Policy Roadmap)* to facilitate adoption of harmonized room AC MEPS by 2020. Following the adoption of the *Regional Policy Roadmap*, ASEAN Member States developed or are currently developing national policy roadmaps. The roadmaps include strategies and actions to strengthen national compliance frameworks, including establishing sufficient testing capacity. All ASEAN Member States agreed to adopt the harmonized test methods for ACs (ASEAN-SHINE, 2015). This strengthens the potential benefits from coordinated and collaborative market surveillance efforts and facilitates round robin testing activities to increase and improve access to accredited testing facilities across ASEAN.

The cooling product market is relatively large in ASEAN, growing at an annual rate of 7.8 % since 2012 to an estimated 8 million room ACs in 2017 (JRAIA, 2018). The largest room AC markets are in Indonesia, Vietnam and Thailand, representing over half of total regional AC sales (JRAIA, 2018). The market for room ACs in ASEAN economies is expected to grow by at least 10 % annually over the next 5 years, driving demand for electricity (Euromonitor). Thailand is the largest AC producer in the region, followed by Vietnam. Malaysia and the Philippines manufacture some room ACs, mainly for domestic markets, but the other ASEAN Member States import cooling appliances for residential use.

Six Member States – Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Vietnam – have implemented S&L programs for ACs, whereas Brunei, Cambodia, Lao PDR, and Myanmar do not have such programs or they are under development. Despite adopting S&L policies, some ASEAN Member States have yet to initiate market surveillance activities including verification testing. The Philippines, Thailand, and Vietnam have established national testing facilities, and others aim to do so in the future[14] (Figure 3).

13. Encompassing Brunei, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam.

14. Internal communication with policymakers at Department of Energy in the Philippines, Electricity Generating Authority in Thailand and Ministry of Industry and Trade in Vietnam.

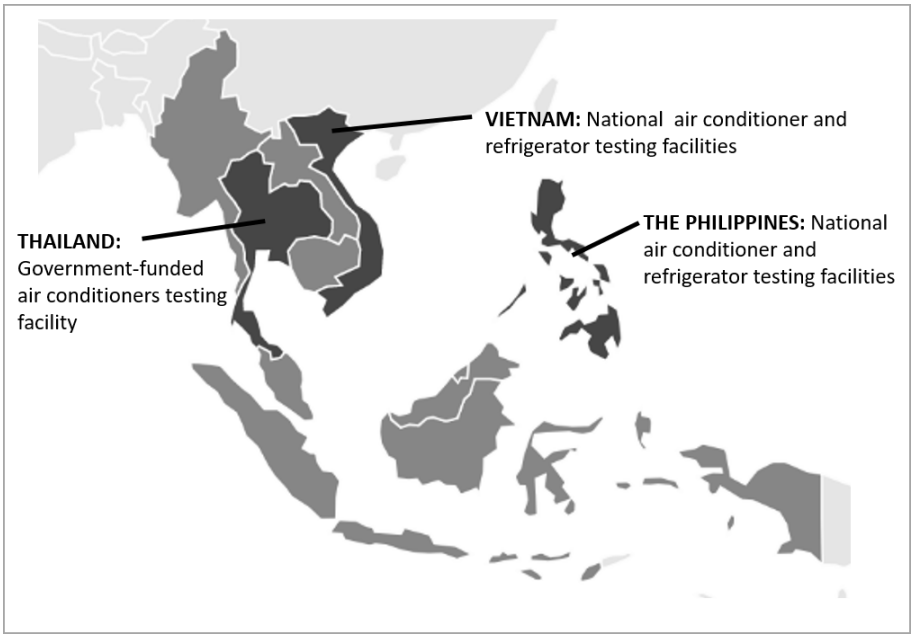

Figure 3. Map of national testing laboratories in ASEAN for cooling appliances (under revision).

Thailand introduced a voluntary AC label in 1996 and mandatory MEPS in 2004 (ASEAN-SHINE, 2015). The Electricity Generating Authority of Thailand (EGAT) is the implementing agency of the EGAT No. 5 Label Program. EGAT considered different testing service options to support their S&L program testing needs, such as building a national laboratory or using private sector or other third-party laboratories. In 2008, EGAT started collaborating with the Electric and Electronics Institute (EEI), which already had a laboratory and was providing product testing services for various stakeholders, including manufacturers[15] (ASEAN-SHINE, 2015). EEI provides testing services for conformity assessment – if manufacturers and importers do not have a test report from a third-party accredited laboratory prior to placing a product on the market, then the product must be tested at EEI to verify its performance (Suwannakut, 2017). As part of their market surveillance program, through inspections of retail stores, EGAT also selects pre-defined product models, which are tested for conformity at EEI (CLASP, 2018b). In addition to conducting testing for the EGAT Label No.5 program, EEI also provides testing services for manufacturers to support their research and development efforts, especially for export products. Thailand considered different options to support their S&L program testing needs and found that most appropriate solution was not to build a national laboratory, but rather to improve capacity at EEI's existing laboratory, which has established competence and resources.

The Philippines recently transitioned from requiring importers and manufacturers to test their product at the national laboratory in the Philippines, which was causing significant delays in product importing, to requiring importers and manufacturers to submit product test reports for registration from any DOE[16]-approved accredited laboratory. As per the aforementioned IFIA study, requiring testing reports from accredited third-party laboratories minimizes the potential of non-compliant cases on the market (IFIA, 2018). The Lighting & Appliance Testing Laboratory under the DOE, which has been recently upgraded and is in the process of obtaining ISO 17025 accreditation,[17] may see reduced need for testing due to these policy changes. No business case was considered for this national laboratory, which will only provide verification testing services for market surveillance under the Philippines S&L program. This could result in underutilization of the laboratory, especially if only a limited number of products are selected for verification testing under market surveillance efforts.

Singapore is the only country in the region that uses Mutual Recognition Arrangements (MRAs) to accept verification test results (ASEAN-SHINE, 2015). Test results are accepted from accredited foreign laboratories, where the national accreditation body has signed a MRA with the Singapore Accreditation Council (SAC). Singapore imports all room ACs, the market for which was 117,000 units in 2017 (JRAIA, 2018). The national S&L program requires manufacturers to submit a test report from an accredited laboratory under the SAC MRA with their product registration application (ASEAN-SHINE, 2015). Despite its relatively large market size, Singapore did not build a national AC testing facility, but rationally chose instead to outsource its verification testing to laboratories in countries that have MRAs with the SAC, such as China, Malaysia, Thailand, and the United States. Singapore's National Environmental Agency randomly selects models from the market and sends them to a contracted foreign test laboratory, allowing for cost-effective market surveillance testing of room ACs.

The ASEAN Centre for Energy (ACE) is developing a regional MRA to support testing of room ACs and other products for energy efficiency performance. This MRA will be modelled on the existing ASEAN Sectoral Mutual Recogni-

15. Internal communication with policymakers at Electricity Generating Authority in Thailand.

16. Department of Energy.

17. Internal communication with the laboratory staff.

tion Arrangement for Electrical and Electronic Equipment (ASEAN EE MRA). The ASEAN EE MRA is intended to facilitate the standardization and acceptance of test reports and certification for new electrical and electronic equipment and allows ASEAN Member States to efficiently test electrical and electronic appliances (CLASP, 2018b). Because all ASEAN Member States now have harmonized test methods for ACs, the regional MRA will enable Member States to leverage testing delivered by their neighbours, without unnecessarily building testing capacity in import countries, and concurrently increasing business and cost-effectiveness for existing laboratories in the region and elsewhere. This MRA can especially help countries that are developing national S&L programs for room ACs use their limited resources for other aspects of compliance. Since there are many existing options in the region for testing room ACs at competent testing facilities, a strong business case for establishing additional capacity is required.

Recommended approaches to building testing capacity

Harmonization efforts in the ECOWAS and ASEAN regions provide national governments with alternatives to building national testing facilities, especially when these facilities require continuous government funding to operate and to maintain competence. Although alternatives are considered in decision-making, policymakers often continue to prioritize national or government-owned testing laboratories to support their S&L and compliance programs, under the assumption that this testing infrastructure is critical to their compliance efforts.

To build sufficient and sustainable testing capacity to support regional and national energy efficiency policies for cooling appliances in both regions, CLASP recommends the following solutions:

CONDUCT TESTING NEEDS AND GAPS ASSESSMENT

When deciding whether to build a national laboratory, policymakers should assess testing needs, available resources, and other variables. This information is critical to inform whether a national testing laboratory will be a sound investment and benefit the compliance program. The following are key aspects to consider when assessing the need for testing capacity:

- *Identify clear objectives*, including the applicable testing standard and verification testing procedure.
- *Assess the testing needs* to support the S&L program.
- *Legal considerations*, e.g. whether the legislation/regulation requires products to be tested in the country.
- *Contingency planning*, e.g. sources of funding in the event of unforeseen circumstances.
- *Ability to obtain accreditation and maintain competence* of the laboratory to ensure reliability of test results.
- *Evaluate regional capacity*, e.g. assess whether other countries in the region offer the same testing services.

Under K-CEP, CLASP is conducting a testing needs assessment that will inform the recommendations for building testing capacity to support national energy efficiency policies for room ACs in ECOWAS and ASEAN.

BUILD A BUSINESS CASE

If alternative solutions are unavailable, and a new national testing laboratory for cooling appliances is a priority, policymakers should build a business case based on the findings from a testing needs and gaps assessment. This way, policymakers can ensure that the national laboratory not only fulfils necessary S&L program requirements but also guarantees sustainable laboratory operations.

When developing a business case, the up-front investment in construction, equipment, and human resources should be considered, as well as a long-term financial plan to fund ongoing operations including maintenance, staff retention and training, accreditation, and equipment calibration. The costs should be compared against expected income from cooling appliance testing services. Policymakers may consider commercial testing services for manufacturers and other stakeholders that can provide an opportunity to collect additional income to cover some of the ongoing costs. To provide consistent, accurate, and reliable test results, laboratories need to obtain and maintain qualifications such as accreditation, the cost of which should be included in the business case. National laboratories that conduct verification testing of appliances under S&L programs should always maintain accreditation to ensure they have robust proof or evidence of non-compliance.

A business case allows policymakers to build the confidence that the decision to build a testing facility is based on sound reasoning and the allocation of scarce resources will provide a beneficial outcome. CLASP is developing a financial modelling tool to be used by policymakers in the ECOWAS and ASEAN regions to make well-informed decisions about establishing national testing facilities for cooling appliances. This tool will be based on testing needs under the national compliance program, which vary depending on the set national program requirements, and, if appropriate, potential for providing testing services to others.

REGIONAL COLLABORATION

Regional collaboration and coordination can strengthen national compliance programs in ECOWAS and ASEAN and help accelerate standards implementation, especially in countries without existing policy frameworks. Regional collaboration programs, including regional product databases, can help participating countries share and exchange market intelligence on non-compliant products, including market surveillance and verification testing information conducted at the national level. If the same product models[18] are sold across borders, sharing this information can alert neighbouring compliance authorities to take action and reduce the need to conduct additional testing (ASEAN-SHINE, 2015). ECOWAS and ASEAN Member States are not obligated to share verification test results, but the benefits of making these results available to other members are significant. Such collaborative programs allow governments to

18. Model numbers may differ among countries; compliance authorities can request information of equivalent models from the manufacturer or importer if there is evidence of non-compliance.

work together to identify non-compliant products, maximize program efficiency, and strategically allocate resources on the national and regional level. Information exchange can also be done informally between national compliance authorities on a bi-lateral basis. For example, Australia and New Zealand share product compliance information through a common database (CLASP, 2018b). Collaborative efforts and intelligence sharing also allows governments to target non-compliant products and remove more of them from the markets.

ALTERNATIVE SOLUTIONS

In some cases, private laboratories in-country or in-region that are accredited by national or regional accreditation bodies can provide competent and competitive testing services. Policymakers can outsource product testing to these private laboratories and use their compliance program funds for other activities such as market inspections.

Bilateral MRAs, which recognize verification test results between countries, can save money for ECOWAS countries that import most of their products. Another alternative is a regional MRA, which ACE is considering for the ASEAN region. Because ASEAN has harmonized test methods, MRAs are the most cost-effective approach to testing, as test reports can come from any accredited test laboratory in the region.

Conclusions

The decision to build a national testing laboratory should not be based on the notion that every S&L program requires a national testing facility, but on a strong business case that validates the necessity of new testing capacity or facilities based on the country's testing needs for their S&L program, a lack of alternatives, and other variables. Alternative solutions such as outsourcing testing to private or foreign test laboratories under bi-lateral or regional MRAs may be more cost-effective. This is highly relevant as the ECOWAS and ASEAN regions are currently working to harmonize standards for ACs and develop collaborative regional compliance programs.

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