Standards for Stand-Alone Solar:

Guidance for Governments

MARCH 2020

Introduction

Off-grid solar solutions have accelerated electrification in sub-Saharan Africa (SSA) due to the ease with which they can be deployed. They have made it easier for governments to fast track universal electrification, especially in areas where grid extension is uneconomical. In fact, electrification in SSA is now outpacing population growth thanks to off-grid solar solutions[1]. Off-grid solar solutions constitute 85% of all off-grid technologies. Consumers of these solar products are enjoying better lighting, improved health, longer working or study hours, higher incomes and new job opportunities[2]. Moreover, consumers undertaking more than two income generating activities after adopting solar, are getting an average additional income of up to $53 per month, as shown in Figure 1.

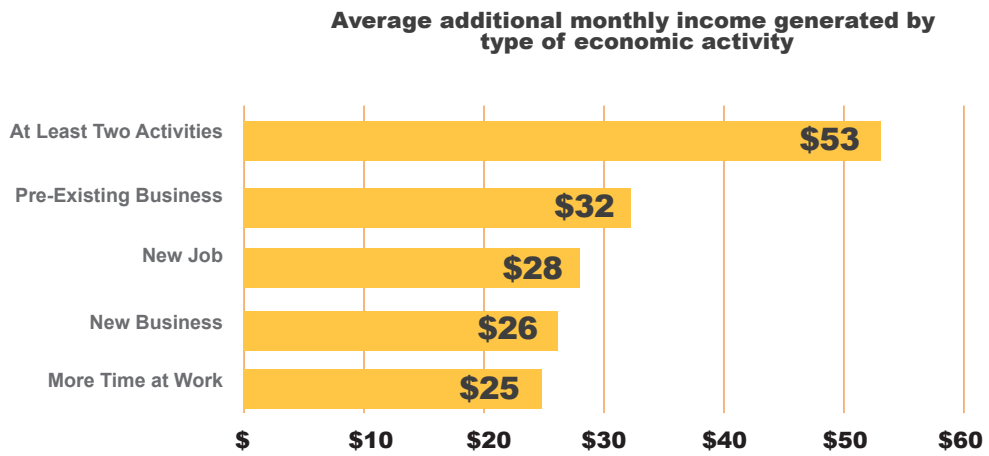


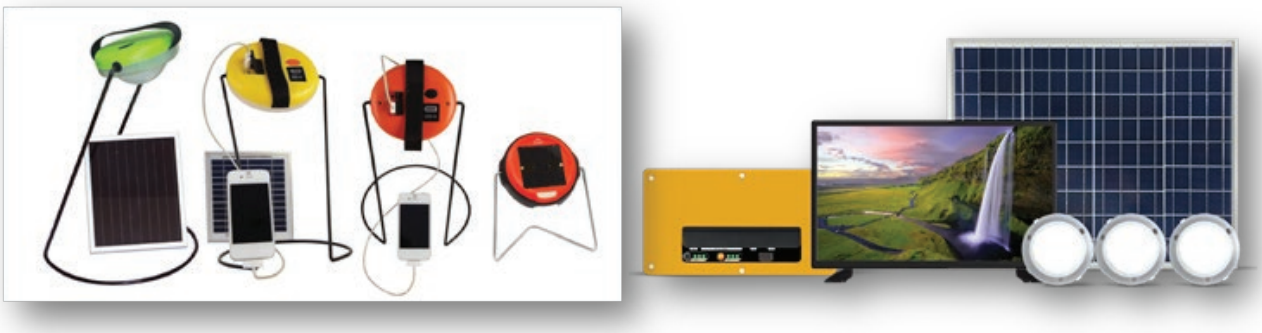
Figure 1: Average additional monthly income households generate after adopting stand-alone solar

Source: GOGLA (2019)

For off-grid solar solutions to continue delivering great benefits to consumers they need to be of high-quality. An effective way of improving the quality of stand-alone solar products in the market is the adoption and implementation of standards. Once national quality standards have been adopted, they must be enforced, and surveillance done to ensure compliance.

This brief provides guidance on:

- The importance of quality standards for stand-alone solar products
- The standards adoption process and status of standards in SSA
- Common challenges encountered during adoption and implementation of standards
- Market surveillance
- Recommendations for governments



Stand-alone solar (SAS) systems consists of pico solar (left) and solar home systems (right)[3].
Photo credit: Lighting Global (left), Niwa Solar (right)

STAND ALONE SOLAR STANDARDS

Why Stand-Alone Solar Standards?

In the stand-alone solar (SAS) industry, particularly in SSA, consumers are susceptible to an influx of low- quality products. Many of these products stop working within a few weeks or months of purchase. As a result, consumers stop trusting solar products, in effect eroding consumer confidence[4]. With time, market spoilage occurs affecting even companies that are selling genuine and high-quality solar products.

The problem of low-quality solar products also has a high cost on the poor and vulnerable population segments. These people have less disposable income (less than $ 1 per day) and mostly make a significant sacrifice to purchase a stand-alone solar product. Due to cash constraints, they also have limited options on what system to buy. Their choice will mostly be influenced by price and what they can afford. Checking on the quality of solar products entering the market becomes critical, so that the poor get value for their money.

Without guidance on what constitutes good quality solar, manufacturers design cheaper products with the aim of selling more units. As competition increases the products can become cheaper with little regard to functionality and durability. Eventually, this can result in a race to the bottom as traders cut corners to deliver the cheapest solar product. Deceived by the price, consumers buy the cheaper products. This creates another problem as solar e-waste begins to build up.
consumers.

A standard is a document established by consensus and approved by a regulatory authority that provides, for common and repeated use, rules, guidelines or characteristics for products and services and related processes or production methods, aimed at the achievement of the optimum degree of order in each context. It may also include or deal exclusively with terminology, symbols, packaging, marking or labelling requirements as they apply to a product, process or production method. Standards ensure that products and services are fit for their purpose and are comparable and compatible.

Governments have a responsibility to protect their citizens from sub-standard solar products and e-waste that will affect the environment, health and well-being of the people. In addition, governments should intervene to protect importers, distributors and retailers who inadvertently invest in low-quality products because they are not familiar with the standards and the importance of quality assurance. One of the most important ways to address these issues is through quality standards, which set a baseline level of quality, durability and truth in advertising to protect consumers[4].

The Standards Adoption Process

Regulatory bodies can develop standards from a clean slate or adopt existing standards like the internationally recognised International Electrotechnical Commission (IEC)* Standards. This section explains the process of adopting IEC standards. In 2013, the IEC adopted test methods (IEC/TS 62257-9-5) developed by Lighting Global. Recently, the Lighting Global Quality Standards have been approved to be adopted by IEC and are expected to be published in June 2020 as IEC/TS 62257-9-8. The quality standards are comprised of two sets, one set for pico solar systems, and another for solar home system (SHS) kits. To protect consumers, governments need to adopt both IEC test methods and the quality standards that cover pico-solar and SHS kits. To show compliance with the standards products must be tested according to the IEC test methods at an ISO -17025 accredited laboratory. The official test results are assessed to determine whether a product meets the standards or not.

Benefits of adopting IEC Standards

Adopting harmonised standards like the IEC standards, comes along with many benefits for the standards bureau, manufacturers, importers and financial institutions[5].
The benefits that accrue to the standards bureau are:

- Increased confidence in standards because they have proven to be effective and functional in other countries and regions.
- Minimal investment required because the standards bureau will not be required to invest in or manage local testing facilities. Quality verification is carried out at internationally accredited laboratories.
- Increased ease of standards adoption since the standards adoption process is facilitated by a complimentary set of test methods and quality requirements.
- Simplified regulation as import requirements are simplified by implementing procedures that are uniform across multiple countries.

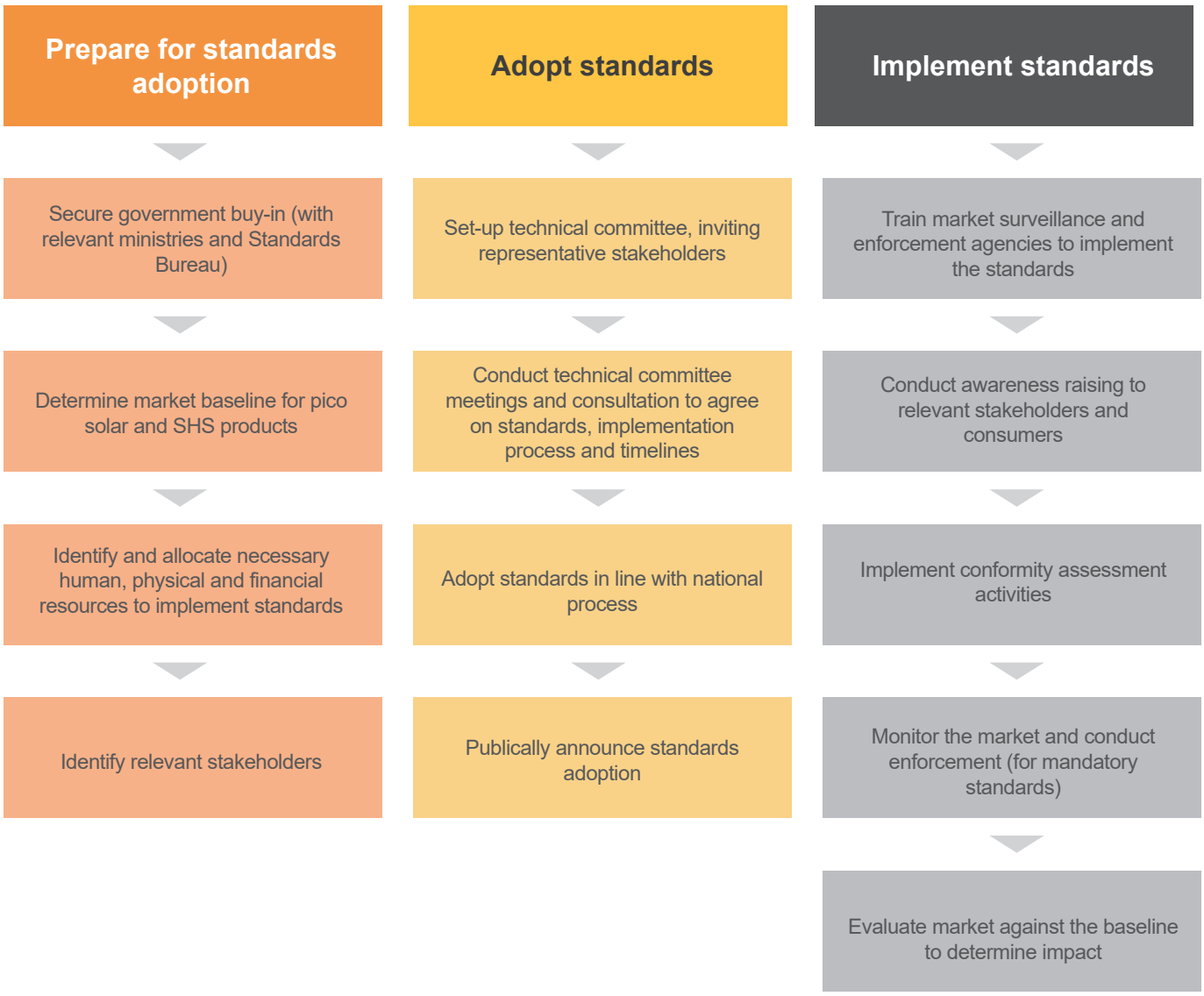
The benefits that accrue to other players in the sector are:

- Manufacturers enjoy increased regulatory consistency and hence do not need to make costly modification to products to meet different standards.
- Importers enjoy reduced importation costs as having harmonised standards means the same verification scheme can be applicable across multiple countries.
- Financial institutions can confidently assess the risk of solar products that meet internationally recognised quality standards.

The standards adoption process involves a series of steps as shown in Figure 1.

*The International Electrotechnical Commission (IEC) is an international organisation that develops global standards for devices that contain electronics and use or produce electricity. The advantage of adopting IEC standards is that they are developed by committees that bring together experts working in related areas across the world. Experts from industry, commerce, government, test and research laboratories, academia and consumer groups are involved in the standards development process

Figure 1: The SAS standards adoption process



Once adopted or gazetted, the standards can either be voluntary or mandatory. The nature of enforcement also differs from country to country and to a large extent depends on the organization and resources of enforcement agencies in a specific country.

Mandatory and voluntary standards

Standards can either be mandatory or voluntary. Both types of standards are developed by the private sector in conjunction with standards development organizations.

Voluntary standards

Compliance to voluntary standards is not required by national governments. Voluntary standards are typically appropriate for nascent solar markets that are still developing, and where enforcement systems are not well developed. In new markets where the risk of counterfeits is minimal, governments can give import duty and tax incentives for compliant products. Sometimes regulators use their statutory authority to enforce voluntary standards in the same way they enforce mandatory standards, even if they are not incorporated by law.

Mandatory standards

Mandatory standards (also referred to as compulsory standards) have been incorporated into law and require compliance by law, regulation, government statute policy or contractual agreement. Mandatory standards are useful for monitoring and enforcing the quality of products in the solar market. Where the risk of counterfeit and sub-standard products is high, regulators can begin with mandatory standards to protect the market.

Status of Standards Adoption in Sub-Sahara Africa

East Africa is ahead of the other regions in adopting standards for stand-alone solar. This is driven by the fact that the market for stand-alone solar is well advanced in this region compared to West and Southern Africa. Kenya and Tanzania have adopted standards for pico-solar products that are aligned to the IEC standards. Ethiopia has also adopted mandatory pico-solar standards and voluntary SHS kit standards, both are aligned with the IEC[6]. Rwanda has adopted guidelines for SHS kits, which are aligned to the IEC standards and include additional requirements.

In West Africa, though governments are yet to fully adopt the IEC standards, they are working though the Economic Community of West African States (ECOWAS) in collaboration with the ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE) and the World Bank Group (World Bank and the International Finance Corporation, IFC) on a regional approach towards adopting the stand-alone solar standards.

In Southern Africa, Zambia is initiating steps towards the standards adoption process. Most of the other countries in the region are yet to adopt. The status of standards adoption in sub-Sahara Africa is summarised in Table 1.

Challenges

The main challenges that have been identified in the standards adoption process are:

Buy-in

The standard regulatory body needs to be convinced on why standards for stand-alone solar are necessary because they also have many other products to regulate. It is advisable to approach the standards body when there is some traction in terms of units sold in the specific country.

Lack of resources

In many cases, governments do not have enough budgetary allocations for adoption and enforcement of regulations. Financial resources are required for the standards adoption process, capacity building of the enforcement officers, awareness creation among stakeholders and resources for market surveillance.

Duration

The process of adopting and implementing standards is generally the same for all countries but the time taken to go through the process differs. The duration is affected by the process each country goes through when enacting regulations for mandatory standards. Usually, the technical committee requires a series of meetings to deliberate on key issues in the standards. However, the period becomes longer when funding or critical resources for the technical committee meetings are insufficient or not available. The duration can also be affected by the unavailability of technical experts that are well versed with the technology. In addition, the time required to create awareness among stakeholders once the standards have been adopted, should be considered.

Table 1: Status of Stand-Alone Solar Standards in Selected African Countries

ACE Country	Pico-solar Standards			SHS Kit Standards		
	Standard Type	Implementation	Harmonization	Type of standard	Implementation	Harmonization
Ethiopia	Compulsory	Enforced for importation via Pre-shipment Verification of Conformity (PVoC)	Aligned w/ Lighting Global Quality Standards; Expected future normative reference: IEC/TS 62257-13-1	Voluntary	none	Aligned w/ Lighting Global Quality Standards; Expected future normative reference: IEC/TS 62257-13-1
Ghana	ECOWAS regional harmonization process underway; National standard type unknown.	n/a	ECOWAS regional harmonization process underway; Normative reference: IEC/TS 62257-13-1	ECOWAS regional harmonization process underway; National standard type unknown	n/a	ECOWAS regional harmonization process underway; Normative reference: IEC/TS 62257-13-1 (once it is published)
Kenya	Compulsory	Enforced for importation via Pre-shipment Verification of Conformity (PVoC)	Aligned w/ Lighting Global Quality Standards; Expected future normative reference: IEC/TS 62257-13-1	Bureau of standards interested in adoption of compulsory standard	Expected to be enforced at importation via Pre-shipment Verification of Conformity (PVoC)	Expected to be aligned with IEC/TS 62257-13-1
Malawi	none	n/a	n/a	none	n/a	n/a
Mozambique	none	n/a	n/a	none	n/a	n/a
Nigeria	National adoption process underway; ECOWAS regional harmonization process underway; Compulsory expected.	Stakeholders exploring process for enforcement at importation and market surveillance	ECOWAS regional harmonization process underway; Normative reference: IEC/TS 62257-13-1 (once it is published)	Adoption process underway; Compulsory expected	Stakeholders exploring process for enforcement at importation and market surveillance	ECOWAS regional harmonization process underway; Normative reference: IEC/TS 62257-13-1 (once it is published)
Rwanda	Compulsory	Enforced by Rwanda Bureau of Standards	Aligned w/ Lighting Global Quality Standards; Expected future normative reference: IEC/TS 62257-13-1	MININFRA Guidelines	Rwanda Government is discussing enforcement approach.	Aligned w/ Lighting Global Quality Standards; Additional service level and warranty requirements

Source: IFC Lighting Global Programme, May 2020

ACE Country	Pico-solar Standards			SHS Kit Standards		
	Standard Type	Implementation	Harmonization	Type of standard	Implementation	Harmonization
Senegal	ECOWAS regional harmonization process underway; National standard type unknown.	n/a	ECOWAS regional harmonization process underway; Normative reference: IEC/TS 62257-13-1 (once it is published)	ECOWAS regional harmonization process underway; National standard type unknown	n/a	ECOWAS regional harmonization process underway; Normative reference: IEC/TS 62257-13-1 (once it is published)
Sierra Leone	ECOWAS regional harmonization process underway; National standard type unknown.	n/a	ECOWAS regional harmonization process underway; Normative reference: IEC/TS 62257-13-1 (once it is published)	ECOWAS regional harmonization process underway; National standard type unknown	n/a	ECOWAS regional harmonization process underway; Normative reference: IEC/TS 62257-13-1 (once it is published)
Somalia	none	n/a	n/a	none	n/a	n/a
Tanzania	Compulsory	Enforced for importation via Pre-shipment Verification of Conformity (PVoC)	Aligned w/ Lighting Global Quality Standards; Expected future normative reference: IEC/TS 62257-13-1	Bureau of standards interested in adoption of compulsory standard	Expected to be enforced at importation via Pre-shipment Verification of Conformity (PVoC)	Expected to be aligned with IEC/TS 62257-13-1
Uganda	Committed to adoption; Compulsory expected	Expected to be enforced for importation via Pre-shipment Verification of Conformity (PVoC); Expected to enforce via market surveillance	Expected to be aligned with IEC/TS 62257-13-1 (once it is published)	Committed to adoption; Compulsory expected	Expected to be enforced at importation via Pre-shipment Verification of Conformity (PVoC); Expected to enforce via market surveillance	Expected to be aligned with IEC/TS 62257-13-1 (once it is published)
Zambia	Initiated Process	n/a	n/a	Initiated Process	n/a	n/a
Zimbabwe	none	n/a	n/a	none	n/a	n/a

Source: IFC Lighting Global Programme, May 2020

Recommendations

Using an inclusive process where stakeholders are involved in developing the roadmap towards standards adoption and implementation increases the likelihood of timeliness and success. It is also a safe way of getting buy-in.

To reduce the amount of time spent on the adoption process, regulatory bodies should consider having a number of technical committee meetings in a secluded location, away from the office and busy towns. This ensures better focus and faster decision making.

Governments should allocate enough financial resources to cover the standards adoption process, capacity building of enforcement agencies, awareness creation and market surveillance. Government may work with development partners to cover some of the initial costs. Governments need to support on-going operations such as market surveillance.

Prior to enforcement and implementation of standards, stakeholders at national and sub-national level need to be made aware of the existence of the standards and their implications.

Quality Standards and Testing

The IEC test methods for pico-solar and SHS kits (IEC TS 62257-9-5) are comprised of both system-level and component-level tests[6]. The components that are tested include LED bulbs, the battery and the solar PV module. System level aspects that are tested include run time, water protection and durability. As described in IEC TS 62257-9-5, the test methods can be used for three different purposes:

The Quality Test

The test is conducted to verify whether a product meets the quality standards (to be published as IEC TS 62257-9-8). Test results are used to verify the manufacturer's claims and provide information for a standardized specification sheet that is available for download on the VeraSol website. Each test is done on 18 randomly selected product samples. Full product testing takes approximately four months to complete.

The Initial Screening Test

It is a test like the quality test but costs less and takes a shorter time. It provides rapid feedback on emerging products for manufacturers, distributors, government agents and non-governmental organisations. It shows the likelihood of a product passing the quality test. The product samples are provided by the company for screening. Only three samples are needed, and it takes about six weeks for the test to be completed. Because of the small sample size and lack of random sampling, the results from these tests cannot be used to demonstrate conformity with the quality standards.

Market Check Test

At least six samples are randomly selected from the retail market and tested to confirm whether they meet the quality standards.

The current practice (under Lighting Global/ Verasol) quality verification is that, product test results from ISO 17025 accredited labs which meet the quality standards are valid for two years. However, if a market check test is done and the results show that the product no longer meets the standards, the product's quality verification can be revoked. The market check test is covered in more detail below.

Conformity Assessment

Conformity assessment is a process that involves testing products, issuing a certificate for compliant products and registration of compliant products in a national or international database so that they are granted market access. For imported products, customs officials then check the documentation before allowing the products into the market.

The benefits of effective conformity assessment are expedited flow of goods internationally, assurance that all products in the market meet regulatory requirements, and cost-savings for market surveillance and enforcement. Poorly implemented conformity assessment could lead to additional importation costs or require expensive market surveillance.

Common ways of conducting conformity assessment include:

Supplier's declaration of conformity: where the supplier declares products have been tested and meet programme requirements.

Third-party testing and certification: where products are tested by accredited laboratories and certified by an accredited body. This form of certification usually leads to higher compliance rates and can reduce the investment needed for market surveillance. Pre-export verification of conformity falls in this category.

Pre- export Verification of Conformity

Pre-export verification of conformity (PVoC) is a conformity assessment procedure applied at the country of supply/origin to ensure compliance of imported products with applicable standards, approved specifications or applicable regulations[7]. It ensures that only products that meet specified standards enter the market. Before the products leave the country of origin, a Certificate of Conformity is issued by an authorised PVoC Agent to show that the consignment of products meets the required standards. Kenya has been using PVoC to enforce standards for pico solar.

Market Surveillance

Market surveillance consists of activities and measures taken by designated authorities to ensure that products comply with the requirements set out in the relevant legislation and do not endanger health, safety or any other aspect of public interest[8]. Market surveillance activities can include field testing, laboratory testing, and visual inspections, among others. Surveillance models include:

Statutory Surveillance

The bureau of standards conducts mandatory checks on the solar products in the market. These are carried out regularly and are useful in identifying poor-quality and counterfeit products in the market.

Risk Surveillance

Areas that are potentially risky due to their proximity to border points or other vulnerabilities are identified. Enforcement officers then conduct spot checks on the solar products being sold in retail stores in the identified areas of risk. This can also be done in areas where poor quality products are likely to have high impact on the consumers or the environment.

Random Surveillance

Samples of solar products are randomly picked from retail stores to confirm whether the products meet the quality standards.

Lighting Global Quality Assurance (now VeraSol) has been conducting programmatic surveillance in countries that have advanced solar markets to avoid market spoilage and erosion of consumer confidence. However, this initiative has been done to support government surveillance efforts in those countries.

Market Check Test

For mandatory stand-alone solar standards to be effective, they must be enforced. The market check test[9] is part of the enforcement process and is done in approved laboratories that have the necessary equipment and trained staff. If a country chooses to carry out market check testing as part of their market surveillance strategy, regulatory authorities will need access to laboratories where products in the market can be tested. The Lighting Global Programme supports and collaborates with testing laboratories in Ethiopia, Kenya, Nigeria and Tanzania. On completion of collaborative efforts, the laboratories will be able to provide testing services for national market surveillance efforts and for those of neighbouring countries.

The testing laboratories and random market check tests are an important part of a standards implementation strategy because they contribute to:

Enforcement of standards: the ability to do random tests on products available in the market strengthens the government's ability to enforce standards.

Verification: verification of standards compliance based on the documentation presented at the port of entry is not always sufficient. Random market tests help to confirm that the products entering the market meet the required specifications.

Act as a deterrent: The random market checks also act as a deterrent to dubious people who may want to circumvent the system.

Protects consumers from exploitation: There are instances where companies import a batch of products that meet the required standards and later import products that are of slightly lower quality. The only way to identify such malpractices is by random market tests. This goes a long way in protecting consumers who in many cases are not aware of the standards.

Sustainable Laboratories

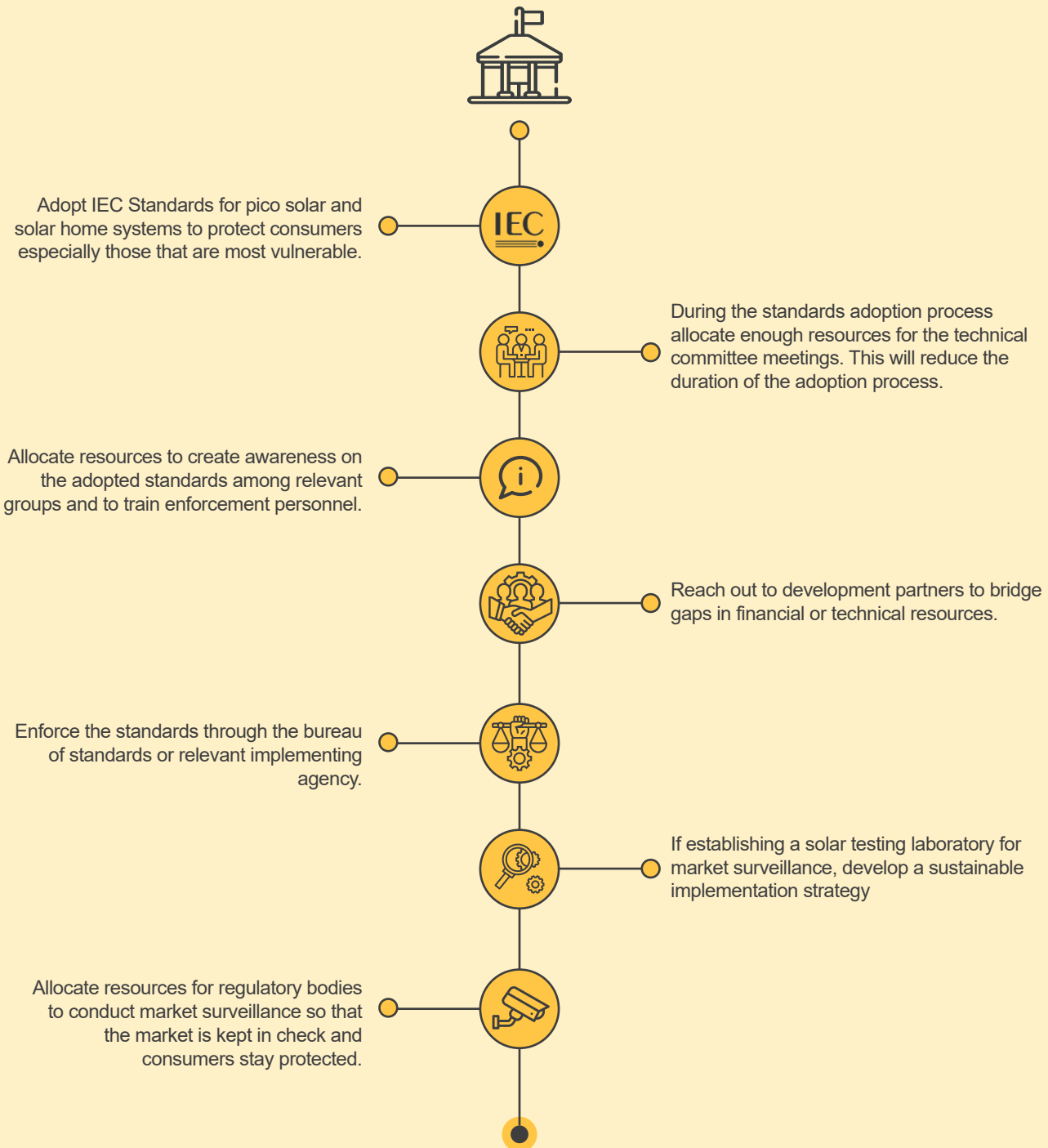
For solar testing laboratories to be successful, they need calibrated equipment, skilled staff, and a sustainable budget for operations. The process of developing a functional laboratory complete with the necessary equipment and skilled staff can take one year or more. Once laboratories are fully operational, they may choose to become accredited to carry out specific tests. Accreditation takes time and requires resources and expertise as guided by the International Standards Organisation certification guidelines[10]. Once accredited with ISO 17025 for IEC test methods, the laboratories are qualified to offer third-party testing service, offer training at a cost and participate in inter-laboratory testing. In 2018, the University of Nairobi (Kenya) was accredited through ISO 17025 to test pico-solar products according to IEC TS 62257-9-5.

Sustained financial resources are also necessary for operating and maintaining a testing laboratory. Before committing to developing a solar testing lab, it is important to have a strategy for covering the costs associated with facility maintenance, renewal of accreditations, employee salaries and re-training, as well as equipment repair, replacement and calibration. Depending on the type of establishment, operation and maintenance costs can be covered by a combination of income from testing services, government support and other income-generating activities such as technician training.

Warning: Avoid Testing Upon Arrival

Where PVoC is not in place, it is critical that regulatory bodies do not conduct mandatory testing of products after they have arrived at the port. Depending on the type of test (refer to Section 1.3) product testing takes from six weeks to four months to complete. If all imported products must be tested, shipments are held at the port during testing, which is at the expense of the importer. This can create a situation that negatively impacts the availability of affordable, good-quality products in the market. Previous experience has shown that should the regulator in a country insist that samples of all imported products be tested upon arrival there will be extremely negative impacts. For example, the testing laboratory is unlikely to have sufficient capacity to handle the large number of product tests requested by the regulator at the pace required. This, has in the past, resulted in products being held at the port, the importers paying large demurrage fees, and a lack of good-quality products in the market. In the period, it creates an avenue for sub-standard products to flood the market via informal channels.

Conclusion: Action for Governments



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This brief is authored by the IFC Lighting Global Team
and the Africa Clean Energy Technical Assistance Facility

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Catalysing Africa's Solar Markets

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