

# How to Maintain Quality Standards in Rural Electrification

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## Webinar Presenter

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## Stephanie

Hello everyone, I'm Stephanie Bechler with the National Renewable Energy Laboratory and welcome to today's webinar, which is hosted by the Clean Energy Solutions Center in partnership with E3 Analytics and the Club of National Agencies and Structures in Charge of Rural Electrification Club ER. For today's webinar, we are focused on the standards for rural electrification.

One important note of mention before we begin our presentations is that the Clean Energy Solutions Center does not endorse or recommend specific products or services. Information provided in this webinar is featured in the Solutions Center resource library as one of many best practices, resources, reviewed and selected by technical experts.

Before we begin, I'll quickly go over some of the webinar's features. For audio, you have two options: you may either listen through your computer or over the telephone. If you choose to listen to the computer, please select the mic and speakers options in the audio pane. If you choose to dial in by phone please select the telephone option and a box on the right hand side will display the telephone number and audio PIN you should use to dial in. If anyone's having difficulties with the webinar, you may contact GoToWebinar's help desk at 888-259-3826 for assistance.

If you would like to ask a question, and we encourage that you do, we ask you to use the questions pane where you can type that in. If you're having difficulty viewing the materials through the webinar portal, we will post PDF copies of the presentation at [cleanenergysolutions.org/training](http://cleanenergysolutions.org/training). There will also be an audio recording and the presentations will be posted to the Solutions Center training page within a few days, and they'll also be added to

the [Solutions Center YouTube channel](#), where you will find other informative webinars as well as video interviews with thought leaders on clean energy policy topics.

Today's webinar agenda is centered around the presentation from our guest panelist Toby Couture. He's been kind enough to join us to discuss maintain quality standards and rural electrification. Before Toby presents I'll provide a short overview of the Clean Energy Solutions Center initiative and then following the presentation we'll have a question and answer session where Toby will address questions submitted by the audience. We'll conclude with some closing remarks and a brief survey.

This slide provides a bit of background in terms of how the Solutions Center came to be. The Solutions Center is one of 13 initiatives of the Clean Energy Ministerial that was launched in 2011. It is primarily led by Australia, the United States, Sweden and other CEM partners. Outcomes of this initiative include support of developing countries and emerging economies through enhancement of resources on policies related to energy access, no-cost expert policy assistance, peer-to-peer learning and learning tools such as the webinar you are attending today.

The Solutions Center has four primary goals. It serves as a clearinghouse for clean energy policy resources. It also serves to share policy best practices, data and analysis tools specific to clean energy policies and programs. The Solutions Center delivers dynamic services that enable expert assistance, learning, and peer-to-peer sharing of experiences. And finally, the Center fosters dialog on emerging policies issues and innovation around the globe.

Our primary audience is energy policy makers and analysts from governments and technical organizations in all countries. But we also strive to engage with the private sector, NGOs and civil society. A marquis feature that the Solutions Center provides is a no-cost expert policy assistance known as Ask An Expert. The Ask An Expert program has established a broad team of over 30 experts from around the globe who are available to provide remove policy advice and analysis to all countries at no cost. For example, in an area of energy access we are very pleased to have Catherine Diavala serving as one of our expert. If you have a need for policy assistance and energy access or any other clean energy sector we encourage you to use this valuable service. Again, the assistance is provided free of charge, and if you have any questions for our experts please submit it through our simple online form at [cleanenergysolutions.org/expert](http://cleanenergysolutions.org/expert). We also invite you to spread the word about this service to those in your networks and organizations.

Now I'd like to provide a brief introduction for Toby Couture who is the founder and director of E3 Analytics, an international renewable energy consultancy based in Berlin, Germany. He works on a wide range of topics in renewable energy, including policy and regulatory analysis, market research, strategy consulting and finance. He has worked extensively with policy makers and regulators on renewable energy strategy and has advised over 40 national governments around the world. And with that introduction, I'd like to welcome Toby to the webinar.

Thanks, Stephanie.

Okay, so welcome everyone. As Stephanie mentioned today we're going to focus on how to maintain quality standards in rural electrification projects. And as many of you know, as anyone who's tuning in, certainly knows this has emerged as one of the biggest challenges in rural electrification, not only for mini-grids and for community-supplied by mini-grids but also in the off-grid appliances market. There's a lot of rapid developments, a lot of new products flowing into some of these markets, many of which don't necessarily meet either national or international quality standards. And this is creating a challenge in a lot of regions in order to try and maintain or control in some sense a flow of those substandard components in the markets.

What I've tried to do today is provide a global overview of the challenge, and to get into some of the details of some of the regulatory solutions that people can do. I've tried to take a bit more of a solutions oriented focus. And hopefully it can help some of you in your different countries in dealing with this critical and increasingly important challenge.

A quick outline of the presentation. First, I'll outline and we'll discuss briefly our quality standards, and after that, we're going to get into the question of how governments can actually enforce those standards. And I'll have some concluding remarks at the end before we open it up to question and answer.

Common cause of the failure of rural electrification projects worldwide is substandard quality, either of the components that are used, of the project design, of the implementation, of the construction, or range of other aspects in the field.

As I pointed out a few moments ago what we're seeing in a lot of markets, both in East Africa, in West Africa, in Southern Africa as well as in markets around the world, in India and Bangladesh, a rapid influx of low-cost, substandard components. And this is creating a number of challenges for both agencies involved in rural electrification, from governments who are trying to support effective electrification of rural communities, as well as from customers and citizens and residents who actually live in rural and remote areas who are trying to access cost-effective solutions to electrify their homes and businesses. So we're seeing this dynamic of both quality impact and impacting a range of different jurisdictions and leading to a host of challenges. So I've listed a few here.

Lower quality components tend to have lower overall lifetime system output. So they don't perform as well as higher quality products. They have less reliable overall operation, so you have more frequent breakdowns, greater need for replacement parts, and a shorter overall lifespan or operating life.

In a mini-grid context, this also leads to higher lifetime system costs. So if you're operating a mini-grid with substandard components you are more likely to face a lot more unplanned interruptions to service, as you seek for components to replace things that are breaking early, or that need to be

replaced early. And that could be the batteries, the inverters, even the wiring in some cases face direct challenges.

So in many cases in a mini-grid context that erodes customer satisfaction. If customers through the mini-grid aren't happy or aren't satisfied with the service that's being provided it can lead very rapidly to a negative, or what's sometimes called a vicious cycle, where customers aren't satisfied, stop paying for their electricity and the failure to pay for the electricity sends the overall business model, the mini-grid, into a negative spiral, as you have decrease in customer satisfaction and decrease in revenues to actually cover the operations of the system.

So in many cases, in a growing number of cases, mini-grids are increasingly being required by law, by regulation, or by donor agencies to actually maintain and install a certain minimum standard of quality components in the system. And we'll see in a few ways in which that's taken place around the world.

For example, regulators recently in Tanzania estimated that something around 65 to 70 percent of pico PV systems, so that's very small solar PV arrays, are of substandard quality in the Tanzanian market. The Tanzanian Bureau of Standards has been trying to introduce new quality standards to try to weed out some of the non-compliant components from the market. And they did a recent visit of 17 different shops, solar shops or electronic shops that are selling solar components. Every single one of the PV shops was carrying substandard components. So you can see that this is not an isolated problem; this is not one that's just happening among certain shop owners who are deciding to carry cheap or lower cost or substandard components, this is a problem that has increased quite widespread, and it's actually spreading to a growing number of markets across Africa, as well as across Asia.

In response to this, we've seen a number of reports published on the topic of quality standards. I highlight one here that was recently published and it's my hope that when AFSEC comes out with a second updated version with more information, more detail, more depth than when the current version is published. This is one—and I include the link there, and it provides an overview of some of the key issues. It's available—it's also doubly printed, so it's both in French and in English for some of you tuning in from French-speaking countries. And I've included the link.

Let's take a quick dive in and look at what quality standards actually are. Quality standards refer to the various technical specifications for the range of different components and aspects of rural electrification projects. That's going to be line fittings, the actual poles, the transformers, the PV modules, the battery systems, the inverters, etc. Any of a number of different components that are used in the system can and routinely do break in practice, in the field. So having high quality standards ensures that the systems have a longer longevity, have better overall performance, and actually in the long term, even though they may cost more up front, provide better value for the money, for both the government and for electricity customers.

So a further benefit of some of the standardization that is taking place and why we see so many different standards being promulgated is it makes it easier to find replacement parts. If you're operating a mini-grid in a country like Mali, or in a country like Rwanda the ability to access comparable, compliant components to actually replace broken pieces in the min-grid is actually a major challenge. And it's getting better as we see more standardization across the market. But in a lot of cases, finding replacement parts can actually take weeks if not months, in some cases even years before the appropriate component can actually be diverted to the market.

In the meantime, the longer that delay goes on customers are living without electricity, or are resorting to more expensive ways of producing electricity, like micro diesel cells. And that pushes up costs and overall carries in itself also a huge social cost because that's money that is being spent on diesel instead of being spent on other things.

It's also important to point out that this doesn't apply only to solar. Standards apply across virtually every aspect of the technological constellation that makes up a rural electrification project. This applies whether it's micro-hydro dams, the generator \_\_\_\_\_, wind turbines, biomass plant, biomass and biogas systems, standards are increasingly playing a more important role.

I've included a few quotes here from the representative from ISO. When I found out, in preparing for this webinar, that there is actually a World Standards Day, which just went by, where they celebrate the value and the contribution of standards to the global economy. So standards are important.

I've highlighted in this section some of the key standards that are being promulgated in rural electrification to support better performing projects and to support the overall success of rural electrification in countries around the world. This is not an exhaustive list. I've [*audio static*] some of these because I think they cover—because they're useful, because they're increasingly widespread, but also because they cover the most important things that regulators and policy makers and standards organizations need to know.

The first one is the lighting global standards put forward by the World Bank. And I've outlined some of the key components or some of the key aspects to those standards here. You can find the link at the bottom to read more of the lighting global standard.

They outline—and I've included them here for a different aspect, they're now developing a wider range of standards, four different, and they're updating the website constantly to tackle these different aspects of the rural electrification market. So as you can see here they're already on version—at least on version 6 of the pico PV systems, so they're constantly being updated. They have a standard for solar home systems, for outdoor cables, pay-as-you-go solar systems and so on.

Each of these documents can be extremely helpful when policy makers or regulators are sitting down and trying to identify, trying to define, trying to draft standards for their individual countries. There's no need, in this case, to

reinvent the wheel. There is not a lack of standards to follow. The question is more which ones and why, and what effect that has on market growth, on the ability of companies to enter the market, of products to be imported versus the products that are produced domestically and so on.

Another set of common standards that are referred to widely is the International Electrotechnical Commission Standards. It's a technical committee specifically tasked with designing standards with regard to solar systems. So in this case I was focused on solar because it's rapidly becoming the most widely used technology for electrification *[audio static]* standards on virtually everything. So it's not just on solar; you can find similar standards for micro wind turbines, for hydro, and \_\_\_\_\_ cells.

And as I point out at the bottom here a number of regulators are starting to adapt, or just directly adopt the standards and setting them as part of the national regulations. So we're seeing some move towards harmonizing in this sector, and that has as a consequence that certain components are actually no longer legal, they're no longer allowed, no longer compliant in individual markets. So they get bumped out because they don't meet the minimum standards.

What this tends to do is it helps to *[audio static]* a race to the top. We start to see the manufacturers, they are no longer meeting those standards, \_\_\_\_\_ we'll lose market share over time, and they will have to step up their products, step up the product quality in order to meet those standards and continue to meet them over time.

So within the ISO standards, which is another \_\_\_\_\_ standards organization, they set out also, across a wide range of products, similar to the IEC standards—and I've included a list here that provides a summary of some of the main standards that apply to solar energy. You can essentially click on these—and I'm putting this all on the website so *[audio static]* slides, can also after the fact use as a resource and can be clicked on and used as a reference document in the future.

Here is a similar list of standards for panels, charge controllers, inverters, even light bulbs, and a similar overview for both wind power and micro hydropower. You can see some of the main, most applicable standards in each individual case.

A lot of this can seem dry. I've included another set here for batteries. But the important thing, at the end of the day, is four companies, NGOs, agencies who are operating in rural electrification having standards, however technical they are helps establish certainty. It helps give the different actors in the marketplace something they can refer to. So if you don't have standards anything can happen, anything goes. And as soon as you have some published government sanctioned, government-supported standards in place in the law or in the regulations it provides a benchmark that all the different actors in the market can refer to. And that way you can almost drive harmonization and more convergence in the marketplace just by having a published standard in place. And I think that's ideally for a lot of regulators that's what they want to

see. They want to see some level of technical convergence of greater interoperability of the different components.

So if something breaks at one mini-grid site, for example, or at one silicon system at one individual household you can very quickly access the bits and pieces you need to replace the components that are broken. And that interoperability can only work when you have certain minimum standards that ensure a basic level of complex \_\_\_\_\_ compatibility in the marketplace. Here's another review specifically on lead acid batteries, and for light bulbs. I'm going through these quickly.

It's important to emphasize, as I pointed out briefly, that standards are not fixed; they must be regularly updated. And they are regularly updated. So one good example is with compact fluorescent light bulbs. Through the 1990s and 2000s—and even until recent years a lot of international energy plans are still trying to push CFLs. These are rapidly beginning to be replaced by LED light bulbs in a number of electrification projects. In fact some mini-grids cannot obtain financing without having LEDs as the default. There are mini-grids in India where the operators of the mini-grid actually will go and destroy the light bulbs that are no efficient, either incandescent or CFLs, and give the customers the LED light bulbs to replace them because they are so much more efficient and because they have greater longevity and just because it facilitates the operation of the mini-grid. You have smaller peaks, overall better power quality, and in a lot of cases [*audio static*] important factor for rural households is they just last longer.

So what we're seeing is a convergence towards—a move away from CFLs and towards LEDs, and I highlight some of the reasons why here. And I think in 10 or 20 we're likely to not see any more CFLs in the marketplace, at least in the residential sector because LEDs are just a superior technology in terms of performance.

As I'm pointing out, on the one hand standards are necessary, but it's important not to forget that they're also insufficient. The biggest challenge for governments is often not simply adopting the standards, it's actually enforcing. And that is one of the focuses—one of the things that we'll focus on most during the course of the rest of the presentation is on the actual mechanisms of enforcement.

So at a high level there are four different types of rural electrification: you can extend the grid, the national network, you can establish mini-grids that essentially serve a smaller group of households, anywhere from 20 to 2,000 households, but not connected to the national network. There are solar home systems that are fully integrated systems, typically with a battery and an inverter built in and the wiring that provide electricity to one individual household. And fourth, the do-it-yourself, off-the-shelf products that you can buy directly and in a wide range of shops and stores, increasingly \_\_\_\_\_.

The off-the-shelf products are like solar home systems, are often—don't come with the full wiring, battery, inverter components that are essentially just there to supply small loads within the household: charge mobile phones and the like.

For numbers one and two here, so grid extension and mini-grids, enforcing quality standards has become a lot easier because it can be done specifically at the permitting stage. So when you issue a permit for the mini-grid or photo-grid extension it can also be done by a tendering procedure, so if you're tendering out, for example rural electrification concessions, as was done, for example, in Mali you can actually bundle in the technical specifications within the tender documents. And that helps maintain—and you want to respond to develop the mini-grid in my country has to meet these minimum standards. So that essentially creates a floor in the quality of the components. You can also ensure that they're compatible with one another. So then you don't have one mini-grid system that's operating according to one set of technical specifications and another mini-grid operator with [inaudible] 20 kilometers away operating according to a different set of standards.

So ideally we're beyond the stage where governments—where we're doing piecemeal, one-by-one projects. We need to see a massive scale-up in rural electrification projects that's going to require hundreds, if not thousands of mini-grids, thousands if not millions of individual solar home systems. So it's at this point in time that it's critical to get the standards in place to ensure that these systems can be compatible with one another and to ensure that ultimately customers themselves are benefitting from having access to higher quality components within the marketplace.

When you look at a lot of the dynamics in either West Africa, East Africa, and even parts of Southern Africa the influx of non-compliant, substandard components is creating a major challenge. So we're really at a crossroads in terms of how to enforce the rural, particularly that end of the market.

As I point out at the bottom, the real challenges emerge mostly in numbers three and four. So in introducing and enforcing quality standards for solar home systems as well as for the \_\_\_\_\_ off-the-shelf product market. So our focus mostly, not exclusively but mostly on numbers three and four. I think that's really where the greatest challenges are.

For number three, if the solar home systems business model is connected or reliant on donor funds, or government funds, the quality standards can also be bundled into the condition for receiving those funds. So if you are relying, as many countries have been, whether in Rwanda or in Senegal, on some government contribution per system or per household, the government can essentially hold on to the funds and not give them out until an actual inspection has taken place to ensure that they can either [audio static] the system not only has compliant components, but also that the system is properly installed. So you can have a quality assurance check before the actual donor funds or government funds are given to the individual \_\_\_\_\_, to the individual business loan.



And if the business model owner or operator knows that ahead of time, if it's clearly written, the overwhelming majority will ensure that the standards are there in the first place because they know that if they don't have the standards met they won't get the money. So that's one way to drive that kind of technical convergence that I was talking about a few moments ago. So with the solar homes systems market it's even arguably easier than in the fourth case, namely the unregulated, informal, off-the-shelf market that we just discussed, and depending on how you envision the future of rural electrification in some of the key markets. The off-the-shelf market could actually become the largest or certainly one of the largest market components by volume by 2030. So this is definitely a booming market segment. And again, that's why I emphasize the timing on this, and getting standards in place now is so critical.

So now let's get into the mechanics of enforcement. How can governments actually enforce quality standards? I've outlined three broad categories. The first one is in permitting and certifying. So certifications up front or permitting before a system actually gets installed. So that's what I consider here *ex ante*—that's typically done beforehand, before the projects are actually built. You can require certain minimum standards before a given mini-grid is built or before a given solar loan system business model gets a right, a permit to operate within the country, or before a shop owner can actually sell a given product.

The second one focuses on inspections, so having actual targeted inspections by some kind of inspector who visits the site or the system after the fact. So this is *ex post*—monitoring and inspecting a system or an activity that's already taken place. So that would mean if you had a government concession for mini-grids a business model goes out and builds seven mini-grids in rural Burkina Faso, an inspector is sent and makes sure the system meets the standards, and if they don't meet the standards they can probably be forced to step up certain system components, pay a fine, or other disciplinary measures.

In extreme cases there's even been some cases where the government actually has to buy back the mini-grid, essentially, and take control over the sight because of poor quality installations or poor quality components. This has happened quite often, particularly with micro hydro projects around the world in markets from Southeast Asia, Madagascar, West Africa—there's a range of different cases where that's had to happen.

The third point is sanctions and penalties. So this is fines or other kinds of penalties. These can be both financial and non-financial. So it can either be a specific legal fine for breaking the law or breaking the standard or not complying with the standard in place, or it can be non-financial. In some cases, as I suggested briefly, regulators can actually revoke operating licenses in extreme cases for a given business activity.

But performing actual enforcement can be quite difficult. It's the actual offenses typically need to be sorted out in law or in the actor in regulation. So you need to have some legal basis for that administrative or criminal fine or criminal proceeding to take place. And that's not always easy, especially in

some of the—in certain cases and in certain markets where either the institutional apparatus isn't quite established or the court systems are not sufficiently processing cases quickly enough to actually make it matter. There's a range of reasons. But the actual enforcement process itself is not easy. It's not as easy as just giving out a parking ticket or charging people on the spot for speeding on the highway.

Good enforcement tends to keep track of some of the people or some of the businesses that are repeat offenders. So for example there may be cases with certain retailers that are continuing to sell non-compliant products. And if they get fined once you can always go back. And if they get fined again you can continue to go back. But at some stages the fines aren't large enough or the legal limits or how large the fine can be isn't high enough it may not actually change the behavior because it may remain attractive for that particular retailer to continue to sell those cheaper homes because those are the ones that people buy than it is to actually comply with the law. They may make more—they may still be able to continue profiting from substandard components and just pay the fine as part of the cost of doing business.

So for people and regulators involved in the enforcement process it requires judgment. And we've seen a lot of thought and a lot of literature on the mechanics, again, of enforcement, and what are some of the different ways of actually introducing enforcement. And I'll get to some of those in a moment.

In certain cases outright product bans may be warranted. So if products are \_\_\_\_\_ example in the news recently with Samsung phones catching on phones. Obviously in some cases there are some components that just should not be sold at all, and outright bans can be, in certain extreme cases, warranted.

Enforcement strategies are ideally both proactive and reactive. That means they need to anticipate where some of the biggest challenges are likely to be, or are, and they need to respond quickly to the developments that are happening in the real market. The solar industry and the solar market in particular is—the off-grid market is, as I pointed out at the beginning, evolving very, very rapidly. So there needs to be—regulators need to be responsive. They need to react quickly to this changing dynamic.

In many countries the theory of enforcement is increasingly focusing in around the notion of responsive regulation. So having an approach that is tailored to the individual profile and behavior of the person who's being targeted, so either the retailer who's selling the components, the installer who's installing them on households or businesses, and finding different ways of enforcing against those particular actor types. And again there's quite a lot of literature getting into what types of responsive regulatory approaches work best in which contexts based on human psychology and human behavioral analysis, behavioral economics, there are ways of designing smarter and more effective enforcement strategies.

So let's take an example. A lot of this sounds probably quite technical and quite high level, but let's take an example so bring it down into a specific

context. So you have a shop owner who has been found by the regulator, let's say the Tanzanian Bureau of Standards, to be selling substandard PV modules and inverters. Inspectors visit the shop and tell them, "Actually these components here on your shelves are not complying with the government standards." They just make them aware but they don't impose a fine. They say, "Listen, you can't sell these." In some cases they'll confiscate them—they'll take the non-compliant ones. That would be similar to a fine. But they don't impose an actual monetary fine.

But a future inspection reveals that the shop owners is still selling the same substandard modules and inverters. So then the inspectors say, "Well listen, you're clearly breaking rules and you're aware of it. We're going to require you to stop selling those products. We're going to take them off the shelves, impose a fine, and we're going to come check more regularly in the future."

But two months later the inspectors find that the same shop owner is still selling substandard PV components. So at this stage regulators say, "Listen, that's enough. We're going to take your operating license. You are no longer allowed, by law, to operate this shop. We're \_\_\_\_\_ police, so shutting down, or the regulator has shut down by revoking your permit, and you are no longer allowed to sell solar components from this location. So as you can see, the sanctions escalate. It's been a responsive approach, a response to the behavior of the individual shop owner to not comply with—by not \_\_\_\_\_ his non-compliance with the regulations.

But as many of you are probably thinking in many cases these approaches with shop owners like this are very, very difficult to actually implement in the markets. And they're very time-consuming. If you have to have an army of inspectors who is going out trying to monitor all of the thousands of different shops that may be present in Tanzania, for example, or in Rwanda or in South Africa or in Ghana selling these components it can become an incredibly expensive process. So there needs to be ways to try to make it more efficient.

And sometimes enforcement can seem kind of like what's sometimes seen in North America like a game of Whack-a-Mole, where you hit one of these little guys and then another one pops up. And regulations sometimes can feel like that, particularly in some of these sectors where there's so many different actors, so many different individual shop owners and business owners, and it can be very difficult and not feel like you're making meaningful progress.

So the result in a lot of markets is that substandard products continue to be widely available, both as \_\_\_\_\_ light bulbs, PV modules, inverters, etc. The problem is not solved. And moreover, the fact that borders within Africa are getting increasingly—well, depending on where you are, are becoming more porous. I think, for example, of the borders between countries like Benin and Nigeria on the West African coast, or between Kenya and Tanzania. It's very difficult to track everything that's going through. So again, it comes down to a question of inspection and monitoring something that's effectively almost impossible to monitor and enforce in practice.

So in light of all that what are governments and regulators supposed to do? A couple suggestions. So first, be pragmatic. It's not possible to eradicate all substandard products from a given market. I'm sure that \_\_\_\_\_ if you're based in Germany, and I'm sure that in a lot of households and farms out in the rural countryside there are people using non-compliant or old machines that no longer meet current standards that are still operating, still being put to use, even though they may be less efficient, and maybe though they may be more harmful to human health and more dangerous for the people using them it's inevitable, even in countries that have very advanced regulatory systems and very strong technical standards in place. So be pragmatic. It's not possible to eradicate everything.

The second key point is make it easier for the actual products that you want to enter the market. So if you want more, for example, solar modules and inverters of a high quality to enter the market create streamlined approval processes, including a very simplified customs process for those certified products so that the customs people know, "Oh, this is a particular panel coming from this particular company, or a particular inverter coming—a shipment of 500 inverters coming from this particular inverter company. Check." And you can let them go through. If you make it easier for the products you want to enter the market you can essentially help address the problem by improving the conditions of competition in the marketplace for those higher quality components because the more the higher quality components get held up at the port. The longer it takes for them to get on the shelf, and the higher the actual and final sales cost, sales price, needs to be in order for that manufacturer or that producer to actually make a return on selling those products into the market.

So make it easier. And I think there's a huge amount of progress that needs to be made, and can be made quite easily or quite readily, I should say, in many markets across Africa to create those simplified approvals and simplified customs processes for high quality, certified components.

The third point is that customer education can definitely help. If customers know to avoid and are told to avoid low-quality components, and you can already help prevent them from buying them in the first place. It won't always work—that awareness never does—as we say, you can take a horse to the river but you can't force him to drink; the same goes with appliances: you can't force people to buy the more expensive or the higher quality ones. But you can increase the awareness.

A further component is these seals, or symbols of quality that the government—there are many governments who are establishing these standards for a wide range of different things, for fair trade certified cocoa or coffee or organic rice, and these need some sort of government stamp or government standard. A similar process can be applied, and in some cases is being applied for solar components.

An alternative approach here is to categorize. And this comes down to how to make your overall enforcement process more efficient. Categorize the

different actors into different groups. So here there's four broad groups. You have on the top left the people, or the shop owners who are well informed and well intentioned. So they know the rules but they're also good, average, law-abiding citizens, as we say. For those people you just essentially need to continue providing information and everything will be fine.

Then you have the people on the top right who are ill informed but they are well intentioned. So they also like to follow the rules, they just don't know what those rules are. For those people a different approach is necessary. There needs to be some guidance provided, a bit more information, a bit more direct assistance to help them comply with these standards.

The two bottom ones are more difficult. So there are the people who are actually well informed—so they know the rules very well, but they're ill intentioned. And I put this in somewhat jokingly here, but one of the best approaches there is to instill the fear of God. Because for people who know the rules very well but don't want to fall with them the only thing they can— one of the only things they can really get them to respond is either the moral pressure or the fear of fines and penalties. So that's a more difficult case. And then the final bottom right one is those who are ill informed and ill intentioned. And there a range of different approaches can be applied. This can be one way to just help keep the overall enforcement process more efficient by targeting the resources, the enforcement resources on the real problem cases.

On a positive front there actually is progress being made. So despite how difficult this is and despite how challenging it is to adopt and introduce standards we are seeing progress. So for example, the 15 ECOWAS-member countries have recently adopted favorable policies to support the standards for IEC technical specifications as part of the process around the National Renewable Energy action plans and the Energy Efficiency action plans that were recently adopted in West Africa. So we are seeing regional initiatives as well as individual governments actually step in and starting to introduce the right standards. And I think we're seeing this also across Asia and large parts of Latin America.

Another positive sign is that a lot of donors have already caught on. They're already requiring minimum standards on any grant-funded projects, and off-grid lighting projects. So we're seeing that overall in the market, despite the difficulty of regulating the sort of off-the-shelf products market there is a lot of progress that has taken place. Also there are a number of important lessons that can be taken from other sectors. So one of the big challenges, not only in developing countries but even in North America and Europe is the question of the issue of building codes: how do you maintain quality building codes in a country? How do you monitor every single little piece of construction taking place?

Building codes are often top down and don't often—aren't very effective. You may, in developing countries in particular—the bar is actually simply set too high. So it's unaffordable to actually build to code. In the Caribbean it was estimated recently that only the wealthiest 15 percent of households can

actually afford to build their homes according to code. So this is clearly a sign of a code that is—or a set of standards that is not well-adapted to the market. So there needs to be a balance between how aggressive these technical standards and codes are and what the realities of the ability or willingness to pay are within that jurisdiction.

Another big issue is that codes can actually increase dependency on imported products and components. And that is another big concern within governments, and one of the factors that slows them down from adopting international standards.

So a few lessons from the building sector that's relevant for the solar and for the off-grid electrification sector is that standards should focus first and foremost on preventing human error. So if there's a significant risk of electrocution, for example, those products should really be—should warrant product bans, and those should be the focus of regulatory efforts in the first instance.

Second, standards should remain realistic in principle. So they need to be adapted to the market. As we saw in the case of the Caribbean, having unrealistically high building codes or standards in the off-grid market in this case doesn't really help. It doesn't make a difference in the actual development of the sector. Because if people can't afford it they will not buy it, and they will not comply.

So finally, then, introducing measures to minimize the price spread, so the price difference between low-quality, substandard components and compliant products should be a top priority. How can governments actually minimize that price difference to encourage more rural residents to actually adopt them? And this applies not only to electrification, it also applies in a major way to the cooking sector with improved cook stoves, minimizing the price spread between cook stoves that are more efficient and the traditional models is critical to driving that adoption. And the economic component needs to be addressed as well. It's not enough to just impose a standard.

So a few concluding thoughts before we open it up to questions. Substandard components are still a big issue and contribute to underperformance in a lot of markets and make it costlier, and make rural electrification slower. So I suggest here that governments across sub-Saharan Africa—this applies more broadly to Bangladesh and to Bhutan and to Indonesia—there needs to be a focus on adopting and actually enforcing realistic quality standards, particularly in some of the more challenging market segments. They need to be adapted, and as I pointed out previously, it's important to be pragmatic. It's impossible to tackle everything in the market.

The goal of standards, it's important not to forget, is actually to reduce the cost of doing business, not to increase it. Because if you have a very cheap, let's just say, micro hydro set you buy it for 50 to 60 percent of the price of the high-quality one, it is more than likely to break down after only a few years of operation because of either a faulty design or just faulty components.

So in the long run buying a higher quality product is the economic \_\_\_\_\_ decision to make, and it's very difficult to convince households who don't have high incomes to make that decision for themselves. That's why in many grids in particular it's that, it's so important for those standards to be in place at the community level so that the individuals aren't forced to pay for [audio static] this process that didn't have high quality built into it from the beginning. So having a high standard of quality does, in the long run, produce an overall bill of accounts of service. And I think that's really critical to understand for electrification efforts. So it's a smarter use of money and better value for money all around.

Another key point here is that clarity is really important. Governments, by publishing standards, can really help improve the overall clarity of all the people operating in this sector. The standards should ideally be published online, so they shouldn't just be written and filed away in some government document. They should be clearly written, in some cases translated, and it should be consistently enforced.

And as I pointed out previously in the middle of the presentation, one of the most critical things that governments can do is actually to make it easier for the products that you want to enter the market, to be able to do so, while making it harder for the ones that you don't. And that helps tip the scales in favor of the higher quality components and away from the low-quality substandard components that are spreading rapidly in many contexts.

With that I think we can open it up to questions from the audience. Thank you very much.

**Stephanie**

Thank you so much, Toby; that was excellent. We've had a couple of questions come in and we will start with—at the beginning of the presentation you displayed an African guidebook for standards relevant for rural settings. And someone was wondering if that's applicable to Asia, or if you have any recommendations for materials that they could find guidance for that continent.

**Toby**

I think the best place to start there would be to click more closely on the links that I provided for either the ISO standards or the IEC technical standards. So in the slides I included a lot of links. And those links can take you on to other pages and other deeper parts of the standards and specifications that apply to international. So I think broadly the trend in international is to adopt either the ISO or the IEC standards. In many, many cases those are increasingly convergent.

And the relying on those international standards just ensures that there is a common template there, there's a common benchmark. And that's probably the best one. The \_\_\_\_\_ emphasis on there for Africa provided some suggestions. It's not as details as many of the ISO and IEC standards are. They're more like guidelines. So I would suggest you look directly at the IEC and the ISO specifications.

For many donor funded projects, the global lighting standards that I pointed to earlier from the World Bank are becoming increasingly widely adopted by donors because for them it's easier to do. Again, there's no need to reinvent the wheel here. It's much easier to simply adopt the standards that have already been—that committees have already spent months and months, if not years, fine tuning, than to go through that process individually.

**Stephanie**

Thank you. And just a reminder to everyone on the line we will have the presentations posted on our website, so you'll be able to access those links mentioned there.

On the topic of lists that people can find is there a list online that you're aware of brands or companies who are repeat offenders to help new policy entrants in the market be aware of those names that you're aware of?

**Toby**

That's a tricky one. It differs widely by the markets. So it would be different in Tanzania than it is in Rwanda, and different than it is in Bangladesh or India, or Nepal, for that matter. So this is a very location-specific issue. Many PV—I'm just taking solar as an example but many manufacturers emerge very quickly, can set up shop—now particularly in Southeast Asia there's an incredibly active market in manufacturing these components with new businesses popping up every day, manufacturing inverters, wires, anything to do with off-grid solar appliances and components market. And it often takes time for those companies to get the standards. Even if they are of decent quality it's hard for them to—because they have to go through their own process to actually qualify with the specifications. So there's an issue there. Some people say that that discourages innovation because it makes it harder for some of the new startups in the industry. But at the end of the day the standards were there to ensure a minimum level of quality. And they're the best benchmark we have. So in terms of actual companies that would differ really vastly, depending on which market you're in. It would be impossible for me to provide a meaningful list.

I think the best—another step the governments can take is actually to create a hotline or an email sort of information clearinghouse where they can openly receive comments from people who are unhappy with a given product or a given compliance-based-specific complaints process.

Now in some markets, in most markets across North America and Europe there are these essentially consumer protection agencies or consumer protection hotlines that you can actually call and say, "Listen, I bought a toaster and it caught on fire." But in a lot of developing markets that's not the case. But I think that would be another meaningful step that governments can take. It's not very expensive, would be to set up that kind of a mechanism, with that kind of a system and encourage people to report issues that they're having. And that can then help governments provide guidance on particular products.

So one good example of this most recently in Malaysia where in the Malaysian solar market there were a lot of companies, a lot of individual installers. This was more an installer issue than it was a manufacturing issue.



The installers, some of them were essentially conducting fraudulent businesses: were taking people's money and not installing, or were just—there were a lot of issues in the market. So what the Malaysian government did in response is they set up a registry of certified installers. But the installers had to be registered at the national authority. And if there were a number of complaints for that particular installer over a short period of time they could be removed from the list of certified installers.

And what the government did is they created a lot of advertising in newspapers and on television to encourage people to go to the site and review the list of certified installers before they bought a solar system. So that may be another approach that's interesting in certain jurisdictions would be to set up that kind of an approved list of certified installers or of certified companies. And that would just make it easier for people to find out what's reliable and what's not.

**Stephanie**

Thank you. And that actually answered our next question from Liz, asking for an example of a successful advertising technique that a country used. So thank you for that.

One person is asking, when it comes to defining national standards do you have any suggestions for how to choose between different existing international standards such as IEC or ISO to use as a reference?

**Toby**

I think, given that those are the two main large ones, and given that there are increasing signs of convergence between them I don't—now again, some engineers might feel strongly about this if they've worked with particular standards agencies or particular components. But broadly speaking it would be fair to say that either of those two sets of technical standards is adequate. I don't think there's any need to worry an awful lot about that. I think having either/or sets the benchmark and the standards can always be further adjusted over time based on local conditions.

And standards can also be published for new products. So for example it's now possible for one regulator to develop the standards for every single appliance all at once. They can typically be published over a period of time. So you start with obvious ones, the more important ones: the inverters, the batteries and the modules. And then you can move on to things like the wiring and some of the fuses and some of the other bits and pieces. But I think broadly speaking it's really more—yeah, I don't think it would be fair for me to give you preference to one over the other. I think both are adequate and both are well-respected and universally acknowledged technical standards.

**Stephanie**

Thank you. For the next question we've had two people write in just the basic problem is that there is an absence of energy law or legislature guiding the procurement or use of electricity in appliances. Do you have any other tips for getting quality control in such an environment like that to introduce any legislature? There seems to be a \_\_\_\_\_ in wanting the penalties which were discussed as not the best method.

## Toby

Yeah, again, in some cases penalties can work. And that's why I included them quite prominently in the presentation. I think the challenge becomes when there's a legislative or a regulatory vacuum, which I think is part of the—if I understood the question correctly it's part of the challenge is just there are no standards. There are no published, acknowledge standards at all, which is the case in a number of jurisdictions, then how do you go forward? And I think governments in that case some of the ministry or the regulator already provided guidance to the market to simply do a bit more advertising and do a bit more awareness raising as an interim measure in the interim before lawmakers actually promulgate or introduce new laws and regulations.

So if there is a vacuum and if there's little sign of anything meaningful happening in the near future, in the next couple years then I think one of the most immediate measures that regulators and governments can take, even without national parliament signing off or the national authorities signing off is to introduce more active advertising and information campaigns to discourage people from buying substandard components. I think that's an experience that anyone in Africa knows. I've spoken with dozens, and even say bordering on hundreds of different people across Africa who complain about all of the substandard, non-regulated, low-quality components that are flooding into the markets. And this is happening whether in Noemi and Kartonu on the West Coast to Kampala in Uganda, you've got issues in almost—virtually in every country.

So this is a huge challenge. And that's why even awareness, even though it's not going to solve the problem awareness can help spread the word and prevent people from making the same mistake that other people have made. And I think that's one role that governments can take, as I said, even without having a law or an act in place.

But again, I would also say that for example the World Bank standards that they've put forward for lighting global that I mentioned earlier in the presentation, those are also kind of readily adoptable. They're made easy. And I'm sure if the government was to contact directly some of those representatives—again, this is fairly straightforward stuff—those I presume—and again, I've worked with some of the folks at the IFC and I'm familiar with the standards that they've put forward, my guess is that they would be happy to help a government in adopting either their standards or globally recognized standards. And I think this is also something that potentially the Clean Energy Solutions Center itself, that this webinar is hosted through, can also publicly help with on a case-by-case basis. So if governments have particular technical assistance needs to do that then I would encourage you to use what Stephanie mentioned at the beginning, the Ask-the-Expert platform and just submit a question into that, and an expert can be identified and mobilized to support the regulatory government agencies in those countries to actually move forward and get those standards developed.

## Stephanie

Excellent. Thank you so much, Toby. We have one final question before we'll move on to the survey. So if there's anything else that anyone would like to ask please submit that now.

The final question is about—we mentioned a lot about products but this one is about quality assurance on services such as maintenance or installation, and if you have any experience with organizing that end of things and how you can verify the services as well as the products.

**Toby**

Yeah, that's a terrific question. I think one of the most common ways with mini-grids and solar home systems is a team of inspectors—again, are dispatched, essentially, to verify the systems, do the checkup, before the government subsidy or the donor grant is actually cashed out, or is transferred to the operator. So this is the default practice in a number of \_\_\_\_\_. It was the case in Mali; it was the case in Namibia under a recent solar development program. This is increasingly common practice. And you have a set of inspectors that needs to be trained. They need to know what they're doing. And the good thing is with inspectors is they get better and better over time. So the learning curve is pretty steep in the beginning, but the inspectors themselves get better and better at doing that work, they get quicker, they know what to look for and—yeah, you're essentially training your own people to be able to do this work and do it well in the inspection space. So that's really one very common and very readily-developable ways to address that.

To the issue of the services and how to maintain the quality of actual processes what some jurisdictions have started to do and what you find actually in some markets, particularly in developed markets, is actually essentially a third party auditor or agency that goes out there and independently monitors or evaluates the customer satisfaction. For example, if you're going to buy—now online if you want to get a customer review of a new car or of a new appliance or a new television or anything you're going to buy you can find customer reviews that provide insight into what went wrong, was the product reliable, are you satisfied. And there are signs in certain developed markets of similar things taking place with solar. So in many jurisdictions, in almost all jurisdictions across the U.S. you have very active, in some cases hyperactive solar markets with hundreds of different installers competing and customer satisfaction surveys and customer platforms that is **evaluated**, the different operators and the different levels of satisfaction are pretty widespread.

I think that is one good way directly to appeal to the people who actually bought these products and services to evaluate them. In some cases the governments can take care of that responsibility as well internally and they can send out a survey and actually ask the beneficiaries of the rural electrification project, "Are you happy with the performance of the operator thus far?" Many new grids actually have this built in as well. I'll take an example, from Morocco, where there is a village committee established for the mini-grid and the village committee was responsible for gathering feedback, positive and negative, around the operation of the system. So how often the power went out, whether there was flicker in the—whether my television went off or all these different bits and pieces of feedback could be sent directly to the committee and the committee will stand directly in contact with the government to report on quality of the operator to make sure that the private operator is actually doing their job and so on. So yeah, there's a wide

range of ways to do that. It depends on the market segment and hopefully just a few examples I've pointed to are helpful.

**Stephanie**

Excellent. Well thank you very much, Toby. That's all we have for questions. Do you have any final remarks before we go to the survey?

**Toby**

No. Again, I think the last thing I would say is just repeating again that the timing has never been more critical. The off-grid solar market in particular is booming, and I would discourage anybody from underestimating how rapidly this is going to take place in the next decade, in the next even couple of years. So getting ahead of this is critical. So hopefully this presentation has contributed a bit to that, and again, the web presentation itself will be available. So you can use the links; you can use any follow-up. And of course if there are any further questions or direct things that I can help with you can feel free to reach out to me directly by the email address that I provided there.

**Stephanie**

Thank you so much, Toby, for the presentation, and thank you everyone for your questions.

We will now conduct a brief attendee survey. So if you could please answer the first question as it launches on your screen: The webinar content provided me with useful information and insight.

The second: The webinar's presenters were effective.

Overall, the webinar met my expectations.

The fourth question: Do you anticipate using the information presented in this webinar directly in your work and/or organization?

Do you anticipate applying the information presented to develop or revised policies or programs in your country of focus?

Thank you all very much for answering our survey. On behalf of the Clean Energy Solutions Center I'd like to extend a thank you to Toby Couture for being our panelist today and to our attendees for participating in the webinar. We've had a great audience and we really appreciate your time. I invite our attendees to check the Solutions Center website if you would like to view the slides or listen to a recording of today's presentation, as well as any previously-held webinars. Additionally you will find information on upcoming webinars and other training events.

We are now posting webinar recordings to the [Clean Energy Solutions Center YouTube channel](#). Please allow about one week for the audio recording to be posted. We also invite you to inform your colleagues and those in your networks about the Solutions Center's resources and services, including the no-cost policy support.

Have a great rest of your day and we hope to see you again on future Clean Energy Solutions Center events. This concludes our webinar.