Standards and Labels: Transforming the Market for Energy Efficient Appliances

—Transcript of a webinar offered by the Clean Energy Solutions Center in January 2012—
For more information, see the clean energy policy trainings offered by the Solutions Center.

Victoria Healey: I'm Vickie Healey with the Clean Energy Solutions Center and I'd like to welcome you to today's webinar focused on Standards and Labels: Transforming the Market for Energy Efficient Appliances. Our presentation today is the joint effort between the Clean Energy Solutions Center and the Collaborative Labeling and Appliance Standards Program, which is also known as CLASP. CLASP provides assistance to standards and labels practitioners around the world by responding to the needs of policy makers and technical experts in targeted countries and regions.

Before we begin the webinar I'd like to go over some housekeeping items and logistics.

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We'll give people a few more minutes to join the webinar but while we wait I'd like to go over a few logistics. You have two options, basically, for how you can listen to today's webinar. In the upper right-hand corner of your screen there's a box that states "audio mode". This will allow you to choose whether you prefer to listen to the webinar through your computer speakers or by telephone. On the audio mode select either "use telephone" or "use mic and speakers". If you select to use telephone the box will display the telephone number and the specific audio PIN you should use to dial in. If you select to use mic and speakers you may wish to check, or to click on audio setup to test your audio capabilities. We ask that you please mute either our telephone or your computer before the presentation starts.

If you have any questions during the presentation

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Please go the questions pane in the box showing on your screen. There you can type in your questions you have during the course of the webinar. We'll make every effort to present your questions during the Q&A segment of today's presentation but if we happen to run out of time we'll post the questions and answers to the webinar archive. If you are having difficulty viewing the material through the webinar portal PDF copies of the presentations are located in the training section at https://cleanenergysolutions.org/

training, and you can follow along on the slides as our speakers present. The slides will be posted with a recording of this webinar to our Solutions Center on the online training archives within the next few days.

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So with that I'll quickly go over the agenda. One quick note I'd like to make before we review the agenda is that I'd like to mention that the National Renewable Energy Laboratory where I work is the operating agency for the Clean Energy Solutions Center. Today we'll begin our webinar with a brief overview of the Solutions Center and then move on to our main topic.

We are honored to have two internationally recognized and distinguished experts in energy efficiency, standards and label program presenting today. We have Dr. James E. McMahon, technical advisor at CLASP, and also we have Dr. Robert Van Buskirk, a senior technical analyst at the U.S. Department of Energy Building Technologies program. I will provide a bit of information on both of our presenters in just a few moments prior to beginning of their presentation. In addition you may view their full bios on the Solutions Center training page.

Following the presentation we will have a question and answer session and a brief discussion on how the Solutions Center can help with strengthening relevant policies and programs.

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Okay a quick overview and background on the Solutions Center. The Clean Energy Solutions Center is a joint initiative of the Clean Energy Ministerial and U.N. Energy. The Solutions Center serves as the first-stop comprehensive clearinghouse of clean energy policy resources. We share a range of policy resources including best practice informational policy case studies, potential and scenario information analysis tools and models for market analysis, resource assessment, deployment impacts, and data on policy and employment status. We also deliver interactive services such as expert assistance on policy-related questions and training via webinars and online videos. Moreover, the Solutions Center is a platform in which policy-makers can exchange information via peer-to-peer blogs and virtual meetings.

Our goal is to foster dialog on emergency policy issues and innovation across the globe as well as assist governments with the design and adoption of clean energy policies and programs. While

our target audience is primarily policy-makers around the world we also provide resources to industry, non-profit sectors, and civil society.

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So in this slide it shows a little snapshot of what the Solutions Center looks like and we invite you to visit and tour around the Solutions Center resources by going to CleanEnergySolutions.org.

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On the Solutions Center you will find resources on energy efficiency, renewable energy, clean transportation, smart grid, low carbon communities, energy access, and other clean energy technologies. And again, we've provided a little snapshot of what types of resources are available on the Solutions Center site. We offer a broad portfolio of peer learning, webinars and training resources such as the one you are attending today including collaborative trainings developed with Solutions Center partners.

One such example is our collaborative webinar series that we've developed with Leonardo Energy and we invite you to review the Solutions Center training page frequently for information on both our past and future webinars.

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A service that we are proud to offer is a no-cost, expert policy assistant feature. To provide this service we have established a technical resource team covering the areas of energy efficiency, renewable energy, clean transportation, and energy access policies. To request assistance you can submit a request through our Solutions Center Ask an Expert feature and we are fortunate to have Christine Egan, who's the executive director at CLASP supporting the Solutions Center technical resource team in the area of appliances and Standards and Labels Programs and Policies.

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Some examples of—we also offer tailored country support. So if a country has a specific need that's unique to them they can come to us and request policy assistance. Some examples of this: the Solutions Center provides, as I said, tailored country support and through a range of activities including country-specific webinars, in-depth technical support to meet an individual country's unique needs. Recent examples include developing—we're working on developing a state and local clean energy policy database for India,

which is modeled on the U.S. Database of State Incentives to Renewables and Efficiency, also known as DSIRE. And we're assisting South Africa with an energy efficiency white tags policy in addition to assisting Indonesia create a clean energy policy network.

Some of our outreach activities and partnerships include feature collaboration with the International Institute for Sustainable Development to provide policy updates occurring around the globe. We will also provide newsletters and ongoing webinars such as the one you are attending today. And this slide shows some of our strategic partners that we work with and collaborate with on Solutions Center activities.

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So our goal is to make the Solutions Center an interactive resource where users can ask questions of webinar presenters, enter comments about the presentation topic and share your thoughts with others. The Solutions Center will provide a gateway to connect with technical and programmatic experts, and we welcome you to share best practices about your renewable energy and energy efficiency program. These are some notes, ideas and things that we encourage you to participate in.

So onto our presentation for the day. We have two speakers. First we have Dr. James McMahon, technical advisor at CLASP.

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Dr. McMahon is an associate and former staff scientist in the energy analysis and environmental impact department at the U.S. Lawrence Berkeley National Laboratory at the University of California in Berkeley. He has over 34 years of experience in energy efficiency standards and energy analysis. Dr. McMahon has conducted economic and technical analysis of appliance and equipment energy performance standards for the United States, China, India, and other countries.

Additionally we have Dr. Robert Van Buskirk, who is a senior technical analyst in the building technologies program at the U.S Department of Energy. He conducts energy efficiency policy and program impact research for the planning and analysis section of DOE's building technologies program. Dr. Van Buskirk's research is focused on long-term appliance and equipment innovation acceleration processes that can assist the DOE buildings technology program in meeting its ambitious goal of economically

decreasing residential and commercial building sector fossil fuel consumption by 50 percent or more by 2030.

So now without further ado

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I will pass the baton over to Dr. McMahon.

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Dr. James McMahon: Thank you, Vickie. I appreciate the introduction.

We're going to be talking today about standards and labels and about how to transform the market. I'll be giving the general presentation and Robert Van Buskirk will step in with an example with a case study for the country of Ghana.

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So first we're going to talk about the organizations involved. Those are the Clean Energy Ministerial, the SEAD Initiative, and CLASP. Then we're going to draw from the CLASP guidebook, which is available online at the CLASP website. That website will be given at the end of the presentation. We're going to talk about the principles for developing standards and labels programs and the initial steps. We'll use the case study of Ghana to illustrate one specific example, and at the end we'll have a question and answer session for about 30 minutes.

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The Clean Energy Ministerial was developed in 2009. It's a forum for 23 major economy governments and the mission of the ministerial is to accelerate the transition to clean energy technologies. There are 11 initiatives including energy efficiency initiatives and clean energy supply. The ministers come together on a regular basis, they met in 2010 and 2011, and the next meeting will be in London in April of this year. There will be subsequent meetings in New Delhi and Seoul. This is a significant group because they represent 90 percent of the clean energy investment in the world and more than 80 percent of the global greenhouse gas emissions.

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So one of the 11 initiatives of the Clean Energy Ministerial is called SEAD. SEAD is the Super Efficient Appliance Deployment

Initiative. And this is focused on efficient equipment and appliances in buildings and industry.

SEAD works at three levels. It tries to raise the efficiency level of products through incentives, procurement and awards, as well as R&D investments. So this is often characterized as the super-efficient appliances. At the same time it's raising the floor by bolstering national policies like mandatory standards and labels. They are also strengthening the foundation of efficiency programs by coordinating the technical work across countries to support these activities.

There are currently 16 SEAD members, so 16 of the 23 members of the Clean Energy Ministerial are participating in SEAD.

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CLASP is the operating agent for SEAD. CLASP is the leading voice for energy efficiency standards and labels and it's also working very much for the ClimateWorks Foundation. So we have a cooperative agreement with the U.S. Department of Energy and we're also partners with ClimateWorks as a best practice network for the appliance sector worldwide.

CLASP provides best practice information and training and technical assistance and expertise to governments and others. Headquarters for CLASP are in Washington, DC with regional offices in Beijing, Brussels, and New Delhi.

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This is a map of the current countries that have energy efficiency standards and labels already in place. You can see that the labels are grouped according to different designs and we'll get into that in a little bit. You can see all of the North American countries, several of the South American countries, the European Union, several countries in Africa and the Middle East. And then also very significantly Russia, China, Japan, Korea, India, Australia, New Zealand and some others.

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So let's talk about the benefits of energy efficiency standards and labels. If we go down the left-hand side of this slide first—first of all standards raise the efficiency of individual products so that reduces the energy consumption. When those products are taken together in aggregate that reduces overall energy use for a utility or for a country. This reduces the electricity power demand and that

reduces the fuel consumption at power plants. So in turn that reduces the need for new power plants to produce more electricity. Let me note here that standards are not just for electricity but they also affect other fuels like natural gas and heating oil.

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The benefits from these programs are reduced capital investment in energy supply infrastructure, increased national economic efficiency by reducing the energy bills, and these standards are typically designed so that the reduction in energy bills is greater than the increase in the investment for our efficient equipment. This enhances consumer welfare, improves energy independence, strengthens competitive markets by providing information to purchasers about the relative efficiencies of products and it reduces emissions both for climate change goals and also reducing local pollution.

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This picture illustrates the effective standards. The blue line shows a distribution of sales of our product as a function of efficiency, where efficiency is along the horizontal axis. So it looks like a normal bell curve: most things in the middle, some things less efficient on the left, and some things more efficient on the right.

The red line shows what happens with standards. Standards set a minimum requirement, and therefore all the products must meet or exceed that requirement. This tends to move the products towards the right end of the distribution.

In addition to standards labels provide information that pulls the market to higher efficiency by informing consumers about what's available. So the green line illustrates the additional pull from the energy labels. So these two work together.

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An example of a success story is refrigerators in the United States. This graph shows three lines. So the blue line is energy consumption of new refrigerators as a function of year. The years are along the bottom from 1987 to 2008 and you can see the blue line shows that the energy consumption of new refrigerators in the United States were reduced from about 970 kilowatt hours in 1987 to under 500 kilowatt hours by the year 2008.

The other two lines show other things that happened at the same time. So the red line shows the size of refrigerators; that's shown

on the right-hand axis. This is not a zero scale. So over this time period the size of a typical refrigerator changed from 20 cubic feet to about 22 cubic feet. In international units that's almost 600 liters up to 660 liters. And so there's a slight increase in size over time. But in spite of that the energy consumption has come down by almost 50 percent.

The other line that's shown here is the green one and this is the real shock and surprise. The average retail price of new refrigerators from 1987 to 2008 went down almost as much as the energy consumption went down. So as manufacturers have made more efficient products they've also learned how to reduce the costs of manufacturing and pass those savings on to consumers. So there's a win both on the first cost and on the operating costs of these products. This is very significant.

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So what we're going to talk about today are the first four steps in a seven-step process for developing standards and labels. The first step is deciding whether and how to implement standards and labels. The second step is developing the capability to test the products so that you can know a fair comparison efficiency from one to the next. The third is the analysis and the process of actually setting mandatory standards. And fourth: designing and implementing a labeling program. The other steps will not be talked about today, so that's designing tech communications campaign, ensuring program integrity and evaluating the program after the fact.

For additional information you can go to the link that's shown here which has the guidebook and it has a complete description of all seven steps.

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So here's an illustration of those seven steps. We're going to start with the first one at the top: deciding whether and how to implement labels and standards, and then we'll step through the next three and we'll leave three on the table for future discussion.

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So the first step in deciding whether and how to do standards there are two critical resources that a country should consider. The first is the legal authority. The country needs to examine whether existing legislation gives the government authority to establish a standards and labeling program. So framework legislation is key.

There are two steps to developing the legal authority: there's the government developing the framework legislation. And typically it's better if the legislation designates an agency that will go ahead and implement the standards and labeling program. This is to avoid the problem of having the legislature always consider changes to standards and do all the technical work. It's better to set up the framework and the authority and then give an agency, a technical agency, the opportunity to go ahead and do the technical details.

Then the agency, in this case, for example, in the U.S. the agency is the U.S. Department of Energy. It defines and establishes the standards. Once you have legal authority you also need a budget, so you need financial resources. The U.S. government spent about $104 million over the first 17 years of the program, which amounted to an annual spending of about six cents per household. It varied from year to year. I should tell you that today we believe the annual savings are about $100 per household. So this accumulates and it's very worthwhile.

Countries that develop new programs can save costs by looking at existing work in other countries. Australia, for example, has a policy of adopting the best standards worldwide. So they survey the existing standards and then look at the economics in their local conditions and then take the standards that best fit. So they don't have to do as much work as a country that's starting from the ground up. I recommend those countries that are just starting out that you take advantage of work that's been done by others.

Now the payback on increased investment in efficient technology is substantial. Our experience in the U.S. is that typically the energy bill savings are 2-1/2 to 3 times the increased cost of the efficient equipment and last over the lifetime of the equipment. And as I've indicated the government investment is paid back hundreds of times through the increased economic efficiency.

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In addition to those resources you also need people to do the work, so qualified staff to manage the implementation, although it's possible to outsource this rather than have government employees. In the United States there's a government agency that has managers that oversee this work, and then there are contractors, including some of the national laboratories as well as private contractors that actually do the detailed work and write the reports. Those reports are reviewed by DOE staff and then redeveloped by the public.

Specialized staff are needed to conduct technical and market analysis. Typically engineering staff are initially involved to define what technologies are possible and then others are involved in looking at the markets and deciding what's likely to happen once the standards are in place. So you also need legal staff in order to set the standards and follow all of those processes and you may need others, for example, to do consumer research about what kind of labels are going to be effective.

Communication campaigns can be important and one also needs to oversee the monitoring and certification and compliance to make sure that everything is going as planned.

For physical facilities you need a test laboratory, or several test laboratories for different kinds of equipment. These can be resource intensive and it can be time-consuming to set them up but these have been done around the world and there are agencies who are private sector partners that specialize in this activity.

In addition you need central offices and sometimes field facilities for monitoring enforcement, depending upon the geographic scope that you're covering. All of this should result in an institution that has program responsibility and can handle all the steps.

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Robert Van Buskirk: Hi, this is Robert Van Buskirk and I'll discuss a little bit the case study of Ghana's experience in trying to follow and implement a standards program.

So one of the key—Ghana being a developing country one of the key issues for Ghana is actually having enough electricity to supply its growing demand. Historically Ghana has been supplied by a very large hydroelectric power plant and one of the key initial motivations for looking at efficiency was the intermittent availability of its hydroelectric supplies and the power crisis that would be created during years of drought.

In 1999 there was a fairly severe drought that created supply constraints and there were rolling blackouts in Ghana, and people within Ghana and collaborators internationally realized that by increasing and accelerating efficiency that many of these supply constraints could be resolved at a much cheaper cost and quicker than through the building of new power plants.

So within Ghana the legal structure, while under ideal conditions where would be a stable, specialized program in reality Ghana's initial implementation of standards was done through periodic

legislative initiatives which would also be supported by various people within the government and within NGOs and through a little bit of donor support. The first efficiency regulations in Ghana were in 2005 for air conditioners and compact fluorescent lights. Specifically the motivation for having labels and regulations for compact fluorescent lights was to help assure the performance and quality of the high efficiency lighting options so that when Ghana then did distribution and incentive programs for CFLs that they would be distributing a high-quality, high-performing product.

After lighting, refrigeration was the next biggest residential energy use of concern. The difficulty Ghana had in sort of taking that next step to essentially replicating the U.S. refrigerator example was that in Ghana approximately 80 percent of the refrigerator market was used products that were sort of rebuilt and rehabilitated and so Ghana had to go through a process of figuring out how to address appliance markets that were not as easy to regulate as standard appliance markets in developed countries. Let's go to the next slide.

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So within Ghana there's a multiplicity of institutions that are related to efficiency regulations and they each take sort of a different piece of the pie. Ghana has a standards board, which is responsible for the detailed technical codification and enforcement of standards. At the same time Ghana has a set of research institutions that are run under the Council of Scientific and Industrial Research. Those research institutions provide the local resource for conducting surveys and analyses and representing the technical information to government.

In addition there's an NGO in Ghana, the Ghana Energy Foundation, which especially in the early years was advocating for energy efficiency policies and regulations. And one institution that came later is within the Ghana government there's an energy commission that's related to the Ministry of Energy that helps promote and develop the efficiency policies within the Ghana government.

So in terms of physical facilities and product certification the Ghana standards board has been active in developing the capacity to have a test laboratory where it's possible to test products within the country but much of the products that Ghana has within its markets are being imported from abroad. And in that context, since Ghana has very few local manufacturers of the products its primary enforcement mechanism is through requirements on verifying that

the imported products are certified. And since there exist regulated markets around the world and certifications for products at various technical levels in Europe and the U.S. and other countries Ghana is working on in essence mapping its local efficiency regulations to the certification in other countries so that if an importer certifies that a product meets a minimum standard in say Europe that is consistent with the Ghanaian standard then that foreign certification winds up being an implicit certification for the local Ghana market.

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This is back to you, Jim.

James McMahon: Right, we're going to pass back and forth.

So as Robert indicated in Ghana most of the products are imported. And this illustrates an important part about the standards program. The regulations apply to both imported products and products manufactured in-country. This is true in the United States and most countries as well as in Ghana. So this illustrates the advantage of harmonization. It's costly to have to test products multiple times in different regions so it's very helpful if the standards or the labels are similar with your trading partners. And as you saw in the map that I showed earlier in the presentation these tend to occur regionally, not just have different labels in every single country.

So if you are considering standards in a new area it's important to consider possibly harmonizing with your trade partners. If they already have standards and labels you should look to those first and see if those will be adequate for your purposes. So this simplifies the customs procedures as well as the testing so that there doesn't have to be costly repeats of tests. This also involves implementing neutral recognition agreements between countries so that as products move from one country to another testing in one place will be accepted in others.

This is best illustrated I think by electronics products, things like computers and fax machines where those are typically traded worldwide and so there are lots of mutual agreements in place. So harmonizing the test methods is a good first step. Many countries use international standards bodies, either the ISO or the IEC as the source of their standards. Sometimes they modify those slightly, but this gives you a universal benchmark against which things can be compared. And if you're using the same test method as another region, another country, then that makes it a lot easier to trade between.

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So in order to go ahead with standard and labels we need data. Market data involves looking at the current range of efficiencies for products. So you can see right away that if you don't have a test and you don't have labels it may be difficult to find out what the range of possibilities is. So tests are typically the first requirement and labels the second.

You might also want to look forward, and we encourage looking forward to new technology. Standards are usually in place for a few years' time and then updated. If there's a new technology that's coming in you want to make sure that it can be tested by the test method so that it can be compared to the existing technology and so that it can be incorporated as it comes in.

It's also important to look at performance characteristics; refrigerators in the U.S. tend to be larger and have some different features than several other markets so it's important to make sure that things are actually comparable. One way to do that is to group the different kinds of refrigerators and deal with those as classes. It's important to look at the efficiency standards in other countries, again, to minimize trade barriers and to take maximum advantage of work that others have done.

So finally we're still in step one of deciding whether and how to implement standards and labels. The programmatic approach can include standards and/or labels, it can be mandatory or voluntary and the labels can be comparative and endorsement, and we'll explain those next.

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I just want to say at this point that these are not either/or choices; you want to develop what the package is. In many countries there is a combination of standards and labels including both mandatory and voluntary labels.

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Robert Van Buskirk: Yes, so in Ghana the first standards were developed for lighting and air conditioning and the development of those standards, Ghana did its initial work in collaboration with an international team at LBNL and did some preliminary survey development to evaluate potential impact. And then based on that international experience and the international data there were initial benefit cost studies and estimations that were used to evaluate the standards in the lighting and the air conditioning area. And those studies

showed big benefits as often happened with lots of energy conservation and a potential for decreasing generating capacity requirements.

Now the initial studies lacked detailed field data, so Ghana followed up with a couple studies. One was a 2003 household survey of the whole variety of energy-using appliances and subsequent field use measurements for refrigerators in particular.

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This slide shows the household appliance survey results. The left-hand column is the type of product and then the right-hand columns show the frequency, or the prevalence of the product, giving the range of the estimates. You find that stoves, well, lighting, stoves, television, VCRs, stereos, fans, refrigerators wind up being the really high use, high frequency products in the Ghana context, and refrigerators, since they use hundreds of kilowatt hours per year of course are high priority.

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To follow up the household survey on appliance saturations and frequency Ghana conducted, again through its local research institutions, through the Council of Scientific and Industrial Research, a field measurement survey. So without labels and certifications in the test lab Ghana made the decision to actually just measure the energy use.

What they did is they purchased a large set of used utility meters from Germany, rewired the utility meters to act as they connected, an outlet plug to the utility meters and they sent surveyors out to hook up people's individual refrigerators to the utility meters, left it for a day or two and measured the daily energy use rate for the appliances. Now this graph of the survey results was very influential in Ghana in convincing the government to implement standards for refrigerators because what you can see on this graph, the two dashed lines at the lower level, the green dashed line, and the blue dashed line show the range of energy use levels that are allowed by the U.S. standards.

And you can see in this plot that the refrigerators in Ghana, refrigerators and freezers in Ghana use two to three times as much electricity as what is allowed by the minimum standard in the U.S. When you turn that into money and the total value that the energy savings might represent for the country of Ghana this turns into approximately a billion dollars over 10 to 20 years and when the

finance minister of the government of Ghana knew that there was a regulation that would save the country a billion dollars his only question was, "Why wasn't I told this earlier?"

So the field use measurements, especially for those appliances which may have very large inefficiencies and large energy uses can be a very important input into motivating policy formation in the efficiency area.

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On to you, Jim.

James McMahon: Right. So when you're considering a standards program one of the issues to consider: which products to deal with. Robert showed a survey that showed how many households owned each of these products and then some field data that shows how much energy they used. So clearly these are part of the criteria.

You want to do policies that are going to have a particular impact and save significant amounts of energy to make it worthwhile. So those products that use a lot of energy or that are used in most households are the first target.

Typically we also look at products that are currently coming into vogue. So the big wave in the developed countries are electronic products and now in developing countries you have cell phones and so forth and computer technologies. Those are places to look also because you do not want to bring in lots of inefficient products and then have to deal with the energy supply side of that.

So other factors are life cycle cost impacts, so you want to make sure that the energy savings compensate for the extra costs of the products so that the consumers and the households are economically benefitted. You want to look for the potential for improvement. As Robert showed, it was very easy to demonstrate once you had the field data in Ghana that they could do much better. I should point out that the same thing was found in the United States in the 1970s if there was a factor of more than two in the range of energy that's used by the same sized refrigerators, different models. And so that clearly demonstrated the opportunity.

In some countries mitigating greenhouse gases is an important goal and energy efficiency standards and labels can certainly help in that regard. Other factors include looking at the manufacturing base. One wants to make sure that the regulations are fair and that

don't limit the suppliers down to one manufacturer so there still competition and consumers have choices between what's available.

Finally there are typically analyses done on what the financial impacts will be on manufacturers to make sure that they remain in business and profitable and the impacts on consumers. And there's a tradeoff there, that as you make standards more stringent it's more work for the manufacturers to change their products but it may also be more benefit to the consumers. And so often there's a negotiation or some kind of analysis by the government agency to determine where the appropriate tradeoff is.

Finally the easiest things to do are places where you already have a test procedure and that there are standards and labeling schemes elsewhere that you can link up to.

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Robert Van Buskirk: Thanks, Jim. So as hinted at earlier, the initial products for Ghana were air conditioners and CFLs. Since air conditioners were prioritized initially because there was a little bit of uncertainty in Ghana as for whether people could afford the initial first cost of more expensive products and air conditioners both were impacting the peak demand, which was impacting the blackouts during the supply constraints and they tended to be owned by the wealthier households in Ghana. So those criteria were part of the decision-making in selecting air conditioners as one of the initial products to be regulated. Also they were imported; there wasn't a big used market; the regulation was easier to enforce.

The CFL regulation was prioritized initially in part because the government was planning CFL promotion programs. In fact during one of its drought years the Ghana government imported 6 million compact fluorescent lights and distributed those at subsidized prices in order to decrease the peak demand on their system.

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Next refrigerators were prioritized because they consume a disproportionately high amount of energy in Ghana and after the lighting is taken care of they have the biggest impact on the poorer households where quite literally a breadwinner in a household, when he gets a [audio break] —

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[Audio break continued]—benefit cost analysis with the air conditioner benefit cost analysis.

You'll notice that in the refrigerator case that the size of the cost is bigger than the air conditioner case, but the scale of the benefits is also quite a bit bigger. And this, because refrigerators have such a large impact on household economics. This is a reason why the government of Ghana is investing quite a bit of resources in development of a good refrigerator efficiency policy, and in this particular case has partnered with the U.N. Development Program and the Global Environment Facility to do a more sophisticated market transformation design through a GEF project that is beginning in the coming years to experiment with incentive programs and early replacement programs and build and invest in the infrastructure necessary to really enforce and implement their new refrigerator standard well.

And then I think it's back to Jim.

James McMahon: Let's stay on this slide for a moment because I think this is typical. So the dark blue lines below the zero are the extra cost for the efficient refrigerator. So you see here its $10 or $20 per unit. So in any one year if you look at 2010 on the left side of the graph you can see there the per capita cost; it looks like about $15 per new refrigerator.

Now each of those bars corresponds to a year in which new refrigerators are bought. Now the light blue on the top are the energy savings. The interesting thing is the energy savings accumulates. So a refrigerator bought in 2010 will continue to save energy over its lifetime. So in the second year you're getting twice as much energy savings because you have savings from the 2010 refrigerators and the 2011 refrigerators. So over the lifetime the energy savings more than compensate for the initial extra cost of the efficient products.

Now look at the red line: the red line is the net effect. So in the first year the extra cost is not recovered but by year three even those refrigerators purchased in the first year are now more than compensated for their extra cost by the energy bill. So this is absolutely typical of what we see in the standard scenarios.

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Okay so we've now talked about whether and how to implement standards; I hope you're all convinced that standards and labels are a good thing. Let's talk about the testing capability.

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So test procedures or test protocols are necessary in order to do a fair comparison of efficiency. The requirement is absolutely they must provide a way to rank order products so that the consumer can tell which product is more efficient than another. Ideally a test procedure should reflect typical usage in the field, and that's not easy because there's a lot of variation in the field. It's very important that test procedures yield repeatable and accurate results. One way to test this is to test a given product among—first of all multiple times in the same lab to make sure you're getting about the same results, and then to test it in multiple laboratories to make sure the labs are all doing the test the same way.

It's also important that test procedures should be as simple as possible so that you reduce the expense involved in doing the testing. And typically you're not testing every single unit but you're testing a sample of units to make sure that the manufacturing is consistent. Test procedures can be developed domestically, or as we indicated earlier they can be adopted from an international body. All testing should be conducted in accredited laboratories to make sure that you're getting the results that you expect.

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Robert Van Buskirk: In the Ghana case my understanding is that the test facility and development is still in process because of the relative expense of testing facilities compared to the income and the resources that exist in Ghana. Ghana is still in the process of developing its test facilities and appliance testing capacity, but because, again, it's relying on imported products and its resources are small compared to the typical international expense of testing products; it's relying more on test procedures that are international and harmonized with other jurisdictions.

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So the Ghana standards board for refrigerators adopted the international IEC test procedures for refrigerating appliances. It did a little bit of adaptation of the international standard, noting that Ghana is a tropical, hot, humid country—selected those classes of refrigerators under the standardized product definitions that correspond to tropical and subtropical countries. And then it

harmonized the stringency of its level with the levels in Europe, mapping its efficiency requirements to the European refrigerator efficiency levels because Europe is the supplier of the majority of imported refrigerators in Ghana.

[Next slide]

Back to you, Jim.

James McMahon: Right. So now we've covered the first two steps; we're going to talk about design and implementation of the labeling program.

[Next slide]

What we're showing here are results from the labeling program in the European Union for refrigerators. Let me call your attention to the red bars first, towards the right-hand side of the graph. The graph shows the market share for different products and they're categorized by their efficiency. The scale here goes from A+ on the left, which are the most efficient, to G on the right, which are the least efficient.

The red bars are from about ten years ago, 1990 to 1992, an initial study in Europe that showed there was a typical distribution with the most sales being in the category D in the middle and with a range of sales from As, the more efficient ones, to Gs, the less efficient ones.

The green bars show what happened by 1997. You can see that the bars are shifting to the right; now the largest market share is for the C class and there's increasing shares of Bs and As and decreasing shares of D through G.

And finally in 2003 the blue bars, where you can see everything has shifted to the left significantly, where the largest market share of 45 percent is in the A category and there are almost no Fs and Gs left and very few Ds and Es.

So here's a case where labels were implemented in the European Union and the range of products moved significantly to the left. In fact it moved so far that they created a new category, the A+, to account for those things that were exceeding the initial A category.

[Next slide]

There's a range of efficiency labels around the world. The one that we just talked about is on the top right, a categorical label with the A through G categories. The one in the middle is the United States

energy guide label. That one shows a bar that shows the range of efficiencies available, the inverted black triangle in the middle there shows where this particular product is. It shows you how efficient it is compared to its competition.

On the left, the categorical label, the dial is a five-star. This is a different way of showing the information. So all of these are conveying information about the range of efficiency but they're designed differently. And typically there should be consumer research done in country to make sure that consumers will understand the label.

On the bottom are endorsement labels. So let me explain the difference between categorical and endorsement. A categorical label is one of the ones on the top that it shows you how something compares to the competition. An endorsement label is either on the product or not.

So on the left we have the United States Energy Star label. If the product qualifies for Energy Star—and this is a voluntary program—then the manufacturer can put the Energy Star label on it. If it does not qualify then the product doesn't have an Energy Star label. So there's no quantitative information other than this product met the specification or it did not. Similar labels are shown here for India and Korea; China and some other countries also have endorsement labels.

Again I want to point out that many countries have both of these things. So in the United States, we have both the continuous label in the middle and the Energy Star label at the bottom, and other countries have similar schemes.

[Next slide]

So comparative labels, as I've indicated, provide a scale that allow consumers to compare and this allows competition among manufacturers. I will tell you a personal observation that the first time the labels are put out there it's common to have the manufacturer that has the least efficient product on the market to stop making that product because no one likes to have their brand associated with the least efficient product out there.

Comparative labels can be mandatory or they can be voluntary, and it varies with the country. Endorsement labels like the Energy Star label are very simple because consumers can just tell whether it's there or it's not. They are inherently voluntary because they're

not seeking to eliminate anything; they're just giving a marketing edge to those things that are more efficient.

[Next slide]

Robert Van Buskirk: In Ghana's case they did a series of marketing studies to evaluate which of the style of labels they wanted to choose. They picked a version of the Star rating, selecting the black star which is in some sense the national symbol. There's a black star in the middle of the Ghana national flag and Ghana has chosen to make these labels mandatory for any products that have a minimum standard associated with them. They selected the label based on focus groups. Of course any label will not be able to avoid all confusion, and in this particular case consumers expressed some uncertainty as to whether more stars meant more efficient or more energy consumption.

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So now Ghana is investing in a capacity to evaluate and try to develop the combination of labels, incentive programs and standards that can create, in some sense, the optimum policy. And in order to do this, as Ghana promulgated the legal standard for refrigerators they also partners with the UNDP-GEF to create a $6 million market transformation experiment and capacity-building program which has eight components. And those eight components include strengthening the institutions that are responsible for energy efficiency. This include customs and the standards board, developing a verification and enforcement capacity because a big issue in the Ghana case is that there's many informal market activity and there needs to be a way of addressing the used product market. Establishing the test facilities as described here so that Ghana can at least do some of its own independent verification of product performance.

In addition, in this particular program Ghana and the U.N. noted the synergy between more efficient products and products that don't have ozone-depleting chemicals like CFCs, and so as part of their program of removing inefficient products from the market they are combining that with a program to remove refrigerators with the ozone-unfriendly refrigerants.

Then they're also developing within the course of this program a program evaluation and monitoring capacity so that they can test the effectiveness of their policies and labels, and they are going to work on developing business and organizational models to try to

make the promotion of efficient appliance economically and financially feasible within the Ghanaian context.

[Next slide]

James McMahon: So next we're going to talk about step four which is analyzing and setting standards. We're going to do this very briefly and then we're going to open it up to questions.

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So energy efficiency standards come in three varieties. At the top here: minimum energy performance standards, commonly known as MEPS are mandatory requirements that specify a particular target threshold. So for example a minimum efficiency or a maximum energy consumption. They do not specific the technology, so an example is the refrigerator standard, which requires no more than a certain amount of kilowatt-hours per year for the refrigerator. It doesn't say what kind of insulation it has to use, what kind of compressor or anything else; it just says whatever design gets to the same efficiency target is going to be acceptable. This is good because it fosters competition between technologies and allows manufacturers to take advantage of their strengths.

A second type is a class average standard, similar to the automobile standard in the United States: the CAFÉ, the Corporate Average Fuel Efficiency standard. That is not part of this program; it's a separate thing but the concept is the same, which is the average that a manufacturer makes has to meet some level. This is harder to enforce. With the first one you can look at any one product, test it, and find out whether it meets the standard. The second one, it involves statistical information about the amount of sales of each efficiency and then averaging those together.

The third one is proscriptive standards which require a particular feature being installed in a new product. An example of this would be a gas-fired water heater that did not have a pilot light but had an electronic ignition instead. These work well in some examples like that but they do not allow as much technological innovation and competition as a performance standard would be. As you can tell, I have a personal bias towards performance standards; I think that allows the best match between reaching your efficiency goals and at the same time allowing innovation and competition.

[Next slide]

Robert Van Buskirk: Yes, in the Ghana case the big considerations on the setting to standards include the impact on low-income groups, making sure that the products are affordable and making sure that it has a positive impact on the businesses that are distributing and servicing appliances in Ghana.

In the room air conditioner case the standard was set at a level with a fairly small incremental cost; it was affordable to the households that are purchasing because it is generally businesses and higher-income households that purchase those particular room air conditioners. So therefore the constraint on setting the standard level in the air conditioner in Ghana was basically the availability of the products. There's a little bit of a survey as for which products at what efficiency levels were found within the market and the levels were set at the higher end of product availability.

In the case of refrigerators setting any standard that requires any sort of certification of the product efficiency performance effectively is a standard that rules out used, rehabilitated used refrigerators. So even though it's a performance requirement in the particular case of a developing country like Ghana putting that certification requirement is almost like a prescriptive requirement, saying that the refrigerator has to be new.

So the pushback in the Ghana refrigerator case will be from the used refrigerator market. What happens is in the used refrigerator market often the way a refrigerator is put on the market is they get an imported used refrigerator shell from Europe and then they add a cheap replacement compressor from the cheapest compressor supplier that they can find and repackage the refrigerator so it's working. And such refrigerators tend to be very inefficient.

So the standard that was set for refrigerator/freezers in Ghana was set more for harmonization and practicality. And the specifics of the level—when I sat in the committee where the standards board was trying to recommend a level for their refrigerators and what they did is they looked at the standards that were being set for refrigerators in other countries. And they found that in China it was being considered to set a standard that would basically be equivalent to the C level for refrigerators in Europe, and Ghana decided that it wanted to be—you know, Europe, maybe they're rich enough to buy efficient refrigerators but if China could afford refrigerators at the C level they wanted to be able to also have their refrigerators at least as efficient as refrigerators in China. So the levels were selected on that basis. And again, as I mentioned

earlier, for CFLs it was that the levels were set to represent just quality product for those particular lamps.

[Next slide]

James McMahon: So we've gotten through the first four steps; the remaining steps will be talked about another time: designing, implementing, communications, ensuring program integrity and evaluating the programs.

[Next slide]

So these are the websites for the various entities we've talked about and I think we're now open for questions.

Victoria Healey: Thank you both, Jim and Robert; that was—presented some excellent information to our attendees. We do have a few questions that have been submitted and I've like to toss those back over to you with the time we have remaining.

The first question is related to MEPS and it is, "We are working on MEPS and labels in Uganda. Do you have cost estimates to establish test benches for AC fridges and small electric motors? Also given that we have very limited resources is it possible to use mobile equipment such as something like a tool that's metered to estimate energy efficiency levels and gauge compliance?" Either of you prefer?

Robert Van Buskirk: I think some sort of cost estimate can be done. It requires a little bit of work in order to come up with reasonable extrapolations that might work for the particular Uganda case, but it's possible to perhaps take some of the data in other places and provide curves or extrapolations that have basically two factors: one would be a scaling factor in an offset compared to the efficiency cost curves that exist in other countries. And then we could put some error bars on that and that could provide at least a starting basis. And then any additional market survey data you could provide would of course tighten those estimates to be quite a bit better. But that's a very detailed question and so do we have a process of getting the contact information and doing some follow-up on this?

Victoria Healey: Yeah, we can make that happen.

Robert Van Buskirk: Okay.

James McMahon: In fact I'd add a comment. I don't have any information specific to Uganda but I can refer you to reports that were done that have cost curves for those products for the United States and for some other

countries. There was work done by Lawrence Berkeley National Laboratory; Michael McNeil—it's published on the CLASP website and also on the International Copper Association website. So we can get back in touch with you with that.

Robert, did you want to talk about mobile measurement? I know you've had some of that in Ghana.

Robert Van Buskirk: Yeah, there's a couple different measurement techniques. So in designing the field measurement programs for Ghana we explored three different types of field measurement approaches. One was adapting used utility meters, which actually wound up being the most robust and reliable method, given the periodic power outages that existed in Ghana.

Another measurement method is plug-in meters, which are called Watts-up Pros. The nice thing about that is this is essentially a power cord that has a day logger inside. Because it has a day logger inside you get high time resolution measurements of the energy consumption that is passing through the extension cord. So that's a nice method because it provides detailed data on the energy use curves for any particular product.

And then the third method is using these little plug-in meters. I guess there's two types of plug-in meter: one we've used is what's called a kilowatt meter. You plug it into an outlet and then plug the device into the outlet and it does cumulative statistics on energy use. And then there's some new wireless plug-in meters that allow sort of real-time monitoring using wireless signals that can connect to your computer. So again, there's several measurement techniques that are possible.

For refrigerators in Ghana we contemplated the use of a simplified test procedure but we haven't verified that yet as a useful rating mechanism for the sake of national scale policy yet. The approach in Ghana appears to be to require that imported products are certified on an international basis according to international standards. So does that seem to answer the question?

Victoria Healey: I think so very well, but again I'll get the contact information if there's any additional information you want to provide to the requestor. Thank you very much; that was terrific.

Actually our next question comes from a participant, Pedro Palencia. He's had his hand raised and we're going to open the mic to him so he can ask a question. Pedro are you on the line? Pedro would you like to present your question now?

[Off mic conversation]

Pedro did you have a question for our panelists?

Pedro Palencia:

No it has been already answered, thank you.

Victoria Healey: Okay so I will move on to our next question which comes from South Africa. The question is, "How do you propose a country deals with golden samples which meet all specifications but all subsequent imported products do not? Often you are not aware that this is the case as you cannot test or verify.

James McMahon: Right, that's an important question. It's important to have some kind of a monitoring process. So you have to be able to test products that you choose as well as products that manufacturers offer to you. So if most of the products are imported it would be important to deal with the importers and to test some of their products to make sure that they're complying.

This gets us to questions of enforcement and compliance in the United States there are monetary fines by the day for products that are out of compliance. And so that provides some incentive for importers and manufacturers to make sure that their products comply.

Victoria Healey: Great. I believe we have time for—go ahead, I'm sorry.

Robert Van Buskirk: Yeah, if I could add to that a little bit. Some of what provides the incentive for compliance in a place like the U.S., and I don't know to what degree it exists in South Africa, but in the U.S. we do have a certain level of authority to pull products off the shelf and test and/or evaluate them. In addition the big retailers who distribute a large fraction of the products are very eager to not distribute products that are not compliant with the regulations. So what the big retailers tell us in the U.S. government is that one of the most expensive things for a retailer to do is to have to do a product recall.

So if there exists the risk of a product recall then that provides a strong motivation for both the retailers and the product supplier to be compliant on all their products.

James McMahon: And two other thoughts: in Europe the consumer organizations often to their own testing and make that information public. And so it would be embarrassing for a supplier to be identified as someone who provided poor quality products.

Also in the United States some of the electric utilities have efficiency programs where they're providing rebates or incentives for efficient products. If they subsequently find out that those products are not providing the savings that they expect they'll do their own checking to make sure that they're actually getting what they expect.

Victoria Healey: Great. Thank you very much for that. I think we have time—yes—for one more question then we can wrap up the webinar. I believe this question—I'm not sure where it came from—but anyway the question is do you have either data or comments that point to the tipping point between introduction of SML and the take-up of more efficient products as graphed regarding refrigerators over the past 20 years? Other factors such as cost marketing and product improvement have obvious influence but at what point does improvement begin to follow action?

James McMahon: Yeah I'm sure that varies with the country. In the United States there's pretty good evidence. So we have average efficiency data for most of the products sold by year, and then you can look and see, compared to the data at which the standard was announced, and then data at which the standard took effect. Typically there is a several-year lag time, typically three to five years, so there's a process that takes typically three years to develop the standard, including consultation with the stakeholders. And then when it's announced it's going to be effective three to five years after that date. So we can compare what has happened to efficiencies to those dates and see the effects. I'd be happy to send you some reports on that.

Robert Van Buskirk: Yeah and we just completed a retrospective study which included the evaluation of the impacts of standards on refrigerators in Europe and we found that the best indicator of the impact of the standards in the regulation is looking at the ratio of the present value of the operating cost for the average appliance to the first cost. And so when we evaluated that ratio of the present value of operating cost to first cost for say refrigerators in Europe between 1995 and 2009 what you find is that without standards the present value of the operating cost was about twice the first cost of the refrigerators for those countries where there wasn't a very environmental market, or where they had lower costs of electricity. So then as standards came into effect that ratio dropped from two to one.

Also, looking back historically in the U.S. standards case, as you see the standards come into effect what happens is over time with

increasing industrial productivity the average first price of an appliance goes down in inflation-adjusted terms. And what a standards and labeling program does is it allows the operating cost of that appliance to go down in tandem with the long-term declines in the first cost of the product.

So I would recommend that if you monitor the present value of the operating cost compared to the average price of that appliance you will see a very clear signal of that sort of ratio decreasing over time as your standards and labels have an effect.

Victoria Healey: Terrific. Thank you so much—all of those answers you provided were very comprehensive and just terrific. So I just want to thank you both, Mr. McMahon and Mr. Van Buskirk. On behalf of the Clean Energy Solutions Center team and all of our webinar participants I wish to express our sincere gratitude for sharing this terrific and very valuable information with us today. So thank you for that very much.

One last but very important item I want to bring up with our participants is just to let you know that your feedback is very important to us and we'd like to ask you how you see this Solutions Center fostering not only EESML policies but other clean energy policies and programs as well. Basically what we would like to know is what we can provide that would be most useful and of value to you? What types of information can we support, best practices, webinar and training topics we can offer, data on policy analysis tools, things of that nature.

So we welcome your ideas and ask that you contact us to share your feedback with us so that we know we're providing services to you that are of most value.

And with that I believe this will conclude our webinar and we thank you all very much for attending today. Thank you.

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