CLEAN ENERGY SOLUTIONS CENTER
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Productive Uses of Energy: Unlocking Socioeconomic Benefits and Economic Viability of Energy Access Infrastructure

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Webinar Panelists

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This Transcript

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Eric Lockhart

Hello everyone. I'm Eric Lockhart with the National Renewable Energy Laboratory. And welcome to today's webinar, which is hosted by the Clean Energy Solutions Center in partnership with UNDP, GIZ, and the Institute of Development Studies at the University of Sussex. Today's webinar is titled Productive Uses of Energy: Unlocking Socioeconomic Benefits and Economic Viability of Energy Access Infrastructure.

One important note of mention before we begin our presentation 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's 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 features. For audio, you have two options. You may either listen through your computer or over your telephone. If you choose to listen through your computer, please select the "mic and speakers" option in the audio pane. Doing so will eliminate the possibility of feedback and echo. If you choose to dial in by phone please select the telephone option and a box on the right side will display the telephone number and audio PIN you should use to dial in.

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type in your question. If you're having difficulty viewing the materials through the webinar portal, you will find PDF copies of the presentation at https://cleanenergysolutions.org/training. And you may follow along as our speakers present.

Also, an audio recording and the presentations will be posted to the Solutions Center training page within a few weeks and will be added to the Solutions Center's YouTube channel where you'll 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 presentations from our guest panelist: Dr. Ana Pueyo, Dr. Butch Gadde, and Monika Rammelt. These panelists have been kind enough to join us to provide an overview of tools, methods, and approaches, including state of the art research findings on how to promote entrepreneurial activities within energy access interventions. Before our speakers begin their presentations, I'll provide a short informative overview of the Clean Energy Solutions Center initiatives. Then following the presentations we'll have a question and answer session where the panelists will address questions submitted by the audience, then 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 April of 2011 and is primarily led by Australia, the United States, and other CEM partners. Outcomes of this unique initiative include support of developing countries and emerging economies through enhancement of resources on policies relating to energy access, no cost expert policy assistance, and peer-to-peer learning and training tools such as the webinar you're attending today.

The Solutions Center has four primary goals. It serves as a clearinghouse of clean energy policy resources but 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 lastly, the Center fosters dialogue on emerging policy 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 marquee feature that the Solutions Center provides is the no-cost expert policy assistance known as Ask-an-Expert. The Ask-an-Expert program has established a broad team of over 30 experts around the globe who are available to provide remote policy advice and analysis to all countries at no cost. For example in the area of energy access and enterprise development, we are very pleased to have Jennye Greene, the co-founder of Embark serving as one of our experts.

If you have a need for policy assistance in energy access or any other clean energy sector, we encourage you to use this valuable service. Again the

assistance is provided free of charge. If you have a question for our experts please submit through our simple online form at 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 today's panelists. First up today is Ana Pueyo who is a Research Fellow at the Institution for Development Studies where she leads energy and climate change research. One initiative she is working on includes looking at key elements energy supply initiatives need to consider to achieve poverty impacts. And another is analyzing systematically the barriers preventing higher investment in renewable energy in Kenya and Ghana and the optimal policies to address those barriers.

Following Ana, we will hear from Monika Rammelt who is an energy advisor with GIZ. She focuses on advising the Federal German Ministry of Economic Cooperation and Development on pro-poor energy access infrastructure, decentralized energy supply, and cooking energy solutions as well as working on strategic and technical advisory for the GIZ's energy access interventions in Asia and Africa.

And our final speaker is Dr. Butch Gadde who is a project manager for Sustainable Energy Solutions for Rural Livelihoods and Strengthening the Resilience of Communities through Community-Based Disaster Risk Management projects for UNDP in DPR Korea. And with those introductions, I'd like to welcome Ana to the webinar.

Ana Pueyo Hello everybody. I'm going to try to prepare my presentation. Okay hello. Thank you very much for the opportunity to present today some of our research and ideas. I hope you can all hear me.

Eric Lockhart Yes we can hear you well Ana.

Ana Pueyo Okay thanks. Yeah at IDS—I don't know if you know the Institute but our main interest is to reduce poverty. My research is very much concerned with the links between energy access, _____ reduction, and productive uses are a key element of that. So just to start you may know that there has been a renewed interest in financing electrification based on a number of initiatives that emerge every day and new pledges of more funds to achieve universal access to energy and to electricity in particular.

This is very much catalyzed by the Sustainable Energy For All initiative and the sustainable development goal of energy that _____ _____ by 2030 access to affordable, reliable, sustainable, and modern energy. The goal includes a target to assure universal access to electricity and to modern cooking by 2030. The target is extremely ambitious. It involves electrifying around 1.2 billion people in less than 15 years from now. So it's very, very ambitious. And the political will to achieve it has translated it more and more funds need to be made available for that.

The new advocates and the new proponents and new political impetus for electrification is based on a belief that increase electrification will lead to economic growth and development of _____ countries whereas now this is not very contested this belief. It has been in the past and I think it's good to start with some lessons from the past. So in the past _____ and ideas we have been analyzing the _____ flows poorly through _____.

And we can differentiate mainly three stages. During the '60s and '70s it was the time of the large investments and large infrastructure like large hydro dams or a transmission distribution that _____. During these times, there was a belief that there was a vision of electricity as a magical force. I include here a quote, "that would transform poor areas into highly productive regions." So it was taken for granted that growth in output would deliver development of poverty reduction goals.

And these goals required energy consumption and electricity. A second stage from the 1980s saw energy falling off the agenda of donors and development actors. This was due to the disappointing results of some of the large electrification programs of the '60s and '70s. So a number of impact evaluations of the World Bank showed low economic returns, low cost recovery, and little evidence of an impact on industrial development.

So international donors moved to finance what they considered to be more basic needs for the poor such as health or education, nutrition or water. And the private sector was expected to finance electricity. But they focused on the most profitable areas which were urban areas. Then we see a new time at moment from the 1990s until today in which electricity has come back to the top of donor agendas. Now research has shown that energy is a necessary but not sufficient factor to achieve development goals. But access to energy is more linked to poverty reduction than to growth as it was before.

So I just want to reflect a little bit on what went wrong in the past. We saw these large grid extension projects were too costly for the weak rural demand. They were also based on subsidized tariffs that damaged the financial viability of the utility. And that's how we saw the quality of the supply was poor because they didn't have enough funds to invest in the infrastructure and _____. Also these subsidies targeted the wealthy—targeted the poor that could actually afford to connect and to buy the appliances necessary to use electricity.

A big _____ was as well that there were very few productive uses. So the load was concentrated in a few hours of the evening for lighting. So this made it financially unsustainable for the utilities. There was an emphasis on hard energy paths like large infrastructure—like bring it to the local communities and someone will use it and it will cause growth. What has changed today—what is different today—is a number of things.

I'll talk first about technological breakthroughs that have changed the picture. There have been a dramatic reduction of the costs of renewable energy technologies that make off-grid adoptions more and more affordable and more and more financially viable. And there have also been breakthroughs in

ICTs. The _____ number of mobile phones—the large penetration of mobile phones increased the demand in rural areas, _____ lighting for mobile charging.

Also the developments, the innovations with ICTs make possible new business models. For example remote control of off-grid facilities that reduces the cost a lot and also cashless business models in which people can pay through their mobile phones. Some pay as they consume. We also see donors more and more ready for soft energy paths instead of the large hard infrastructure approach that we saw before. So donors are more ready to match the energy use to the energy sources.

So they are more interested—donors and also public, the public sector in their own countries and *[inaudible comment]* that grow as demand grows in finding and sustaining anchor loads and promoting anchor loads. Also in providing locals basic services instead of the full package of grid extensions where this is what is needed by the communities. And we also see increase interest in integrated planning. So often planning for the electricity sector only included the grid. Now we see more and more readiness to integrate the grid and off-grid planning in the national planning documents.

So our research in IDS as I said before is very much interested in finding what are the links between investment in generation and transmission and poverty reduction. So we have to have a lot of—we have reviewed a large amount of evidence. We have reviewed—a literature review. I don't know if you've seen it. I include the link at the end. In analyzing more than 150 studies to see what were the links we came up with the evidence that this is the causal chain through which investments in generational transmission lead to increase in labor and business income that can facilitate poverty reduction.

So first you have the investment. Then you need poor users to be targeted. Then you need these users to actually connect and use electricity. Once they connect and use electricity there are a number of services that are provided that can lead to some direct and indirect impacts. For example you can see here the impacts that are expected for households and businesses. And these uses can lead to increased income. However this is not as simple as it looks.

To move from each of the links to the next there are a number of recommendations that need to be in place. There are also feedback loops between all these elements. So just to show you quickly some of what evidence says. If we look at the first link are poor users targeted? What we see is that cost recovery is key. So in the selection criteria for grid extension and private grid initiatives those communities that are the most likely to be able to pay for the service are those that are targeted than those that are more cheap to electric.

So we see that communities which a high productive potential and with a large base of economic activity are those that are targeted first. You see here a number of criteria. I won't go through each of them but this is what the investors target. So we see that with an explicit policy intervention involving either subsidies to the service for the people who cannot pay for them. Or

increasing demand for the service through promoting productive uses. The poor are very unlikely to be targeted.

So if we go to the second link, is there evidence that the poor people actually connect and use electricity once it's made available for them? We also see that this is not of use. This doesn't happen on the _____ and again shows that connection rates remain very low even years after electricity reaches a community. And the poor take longer to connect. When they do their final use is very low and is limited to uses such as lighting or mobile charging or sometimes TV.

This makes cost recovery very difficult. So the key barriers to increased connection and use—evidence shows that they are mainly financial and that affordability of upfront costs is very important. So the possibility to pay for the connect fee and for the appliances that required electricity. Also affordability of _____ we also see that the low quality of supply prevents use particularly for productive activities. So when the quality of electricity is very low the use remains low because it's not dependable. You cannot rely on it when you need it.

So there are also policy interventions that can help to cover the affordability gap such as progressive subsidies, new business models. The removal _____ of upfront costs, for example through pay as you go. Lower cost of finance for developers; usually developers have to find equity costs of 20 percent. This makes the service very expensive. And also increasing income generation in the community.

Also with regards to the final impacts that we were saying we expect electricity to lead to income generation. We have seen a strong evidence for direct and short-term non-income benefits for households. That's in group _____ locations. It includes time use. Like they can release time from drudgery at home and use it for leisure, care, study, or to do paid work. But we see a weaker evidence for income related impacts.

And this is because whether or not the tender is released is used for income generation depends on the employment of both _____ of the region. And very often there is a little _____ for supply but there are not employment opportunities. With regards to businesses we also see strong evidence on improvements in probability, extension of opening hours, et cetera. But we see weaker evidence of the impact of electricity in business income and profits and in increasing the number of enterprises.

This is because there are a number of many older elements that need to be in place, mainly for example access to markets, sufficient production scale that makes investments in electricity worthwhile or skills. So we conclude on its own electricity cannot increase the income. Opportunities are reduced already. Employment opportunities and access to markets need to be promoted to integrate the development programs.

So I will show as the final aspect of my presentation some research that we are doing in Kenya on the impact of mart micro-grids for the development

world. The project is based in Kenya, Malawi, and Nepal. We are working with engineers in _____ University and with the University or Nairobi _____ _____ as well. So the assumption that the project departed with and you can see it in this graph is the _____ _____ as you provide better quality electricity to communities energy initiates business as we saw the assumptions that our new study made.

Then businesses grow and they can afford more energy. And there is a virtuous circle that happens as you provide good quality electricity to the community. So what we wanted to know is does this really happen—this assumption that this new study made—and under what circumstances. We are focusing our study in Kenya. Kenya is very relevant because they are following a very ambitious electrification strategy. They have grown from a 20 percent access rate in 2012 growth to 50 percent now.

And they aim to reach universal access by 2020. And off-grid solutions will pay a key role in achieving this. It's very important to see what impact these off-grid solutions in particular in _____ _____ have in the communities that they arrive. And as they arrive to the less _____ communities to those that are the least attractive because they have been the last, they don't meet many of the selection criteria that the first communities to be electrified would meet. It's interesting to see how access impacts in these communities.

So the intervention—the activity that is taking place. You can see in this photo the kind of system that we are talking about. It's small solar micro-grids of up to five kilowatts. They are fully private-led. So they are priced for cost–recovery. It's a smart system in which no cash is used. All the users pay by phone. And the project managers can see the performance of the system on all their payments remotely from anywhere in the world.

The connection fee is very small. With this they wanted to remove the burden of the upfront costs. But the consumption tariffs are very high. They are three times as high as the grid. The tariffs have been designed to recover the costs and also they are based on a study that they _____ how much people were paying for the services that electricity could provide. And they set up a similar amount. So they are paying a lot more than people with great connection would have. And as I was saying it's an interesting case because off-grid solutions are a big part of Kenya's strategy for universal access.

The outcome variables that we wanted with our study are all related to income generation and business performance. So we were looking at the impact on opening hours, employees, profits, costs, revenues, assets, number and type of enterprises. The methodological challenges—the key when you do an impact evaluation is to avoid selection bias, which means comparing directly communities with electricity with those without electricity because often communities with electricity have been selected for a reason because they have a higher potential to—a higher productive potential.

Therefore if they perform well it's because they did have that higher potential to start with, not just because they got electricity. So the keys to find a valid counterfactual—and to do this we will apply difference-in-differences

approach which compares before and after outcomes for treatment and control communities for businesses with and without access to minigrids. Just to let you know I cannot show you results yet. We are at the stage we just got our endline data and we have to analyze it.

So I'm just showing you to progress of the _____ that you'll have to wait until the end of the year to have some results. Yes they surveyed communities, you can see here in the map in red. These are our control communities. In green these are our treated communities. We have six treated with minigrids and six controls without. The way we chose them; the project developer did surveys to more than 100 communities in Kenya and they were ranked for their _____ sites according to a number of criteria.

They shortlisted 25 potential communities and an investor selected 9 sites at their discretion, which were not the top ranked. So they were not the best sites. And we used the remaining 14 shortlisted communities to select controls. And we used covariates to select appropriate controls. We have already done baseline and endline surveys. You have the numbers here. We have 346 businesses surveyed in the baseline, 388 in the endline.

I can show you some of the characteristics of the communities. All of these communities except one depend on livestock for their livelihood. As you can see here the businesses are mainly services-related. There isn't any manufacturing apart from like yes there are some mills. It's mainly services. As you see most of the businesses are with _____ shops. Some difficulty that we'll have to actually see what the impact is of minigrids is that solar power was already pervasive in the baseline.

Solar home systems, which is the yellow corner here were available in a large share of the treated communities and even much larger in the control communities. So we'll have to think about how we see the differential impact of minigrids. It's also interesting to see what business perceived to be their gain and constraint to growth because this also explains how electricity can help them. You see here in the red color the main constraint to growth of these businesses is that there is not an _____ _____. They don't have access to markets.

So electricity is unlikely to be able to change this unless there are other interventions that provide these businesses with access to markets. Just to finish as I said we still haven't analyzed the results. But some preliminary feedback just from the visits that we have done to do the surveys is that the cost of minigrids is considered too high for many of the businesses. Many of them are disconnected. So there is also a study that the regulator—the _____ regulator—has done around the cost of private minigrids.

And they find that only around ten percent of people in rural communities can afford them if they are 100 percent private. But on the positive side supply is reliable. And it's a high quality supply. And it enables many uses that they couldn't have before. Our respondents also said a lot that higher impact could be achieved if electricity is somehow linked to their main livelihood, which is

livestock, the livestock sector. So for example cooling of milk or also irrigation in agriculture—in communities that have agriculture.

They also refer to stocking perishables could reduce a lot transport costs. And energy for community services would provide a big impact for _____. This is all from me. The next steps are I hope to have final results by the end of the year about this study. And here you can find some of the resources, some of the research that I have based my presentation on. This is my 15 minutes. Thank you so much.

Monika Rammelt Thank you Ana. Eric should I just continue?

Eric Lockhart Yeah, sounds good. We can hear you well.

Monika Rammelt Okay, all right. Thank you Eric for the introduction and also the opportunity to speak with both Ana and Butch on the topic of Productive Uses of Energy today, a topic that we at GIZ have been working on for quite a number of years. More recently we have seen an increased interest in the topic and mainly as part of the discussions around load factors and economic viability of minigrids. So today we would like to use this opportunity to spread the word about the various guidelines, studies, and other publications and tools that are geared toward increasing economic activities and energy _____ and interventions which GIZ and its partners released during the last couple of years.

Some of the publications that we're going to talk about date a few years back and may already be known to a wider audience such as the produce menu, which I'm going to talk about in a minute. However we believe that they are still relevant and useful for project practitioners and hence we included them in this overview. I'm going to take you through the individual publications step by step together with my colleague Caspar Priesemann who is sitting next to me right now.

But before, let me say a few words on our rationale for working on the topic from an energy project point of view rather than leaving the job to our colleagues responsible for local economic development. So what do we actually mean when we speak of Productive Uses of Energy? We define them as agricultural, commercial, and industrial activities involving energy services as a direct input to the production of goods or provision of services.

And by that we include home businesses and non-monetary income. However we do not include—we exclude—energy use in social infrastructure such as in schools or health centers. And our definition of Productive Uses of Energy cuts across different sectors, energy sources, and types of enterprises. Why are they important to look at? We believe that they can be a significant driver of economic growth and social progress in developing countries.

Productive uses of energy can underpin the creation and upgrading of value chains. They can facilitate the diversification of economic structures and livelihoods to reduce the vulnerability to multiple stresses and external shocks, and enhance the commercial viability and financial sustainability of

infrastructure investments. Now what does this mean in practice? Productive uses of energy may convert into additional sources of income for end-users and increase their ability to pay bills and recoup investments and grid connection or standalone systems as well as end-use equipment.

Furthermore we see that Productive Uses of Energy can increase the economic viability of minigrids through higher load factors particularly during daytime and hence offer a baseload and higher revenues for operators. And they can increase the technical durability of energy infrastructure through an improved operator ability to cover cost of operation and maintenance. And ultimately through these factors enhance the impact of rural electrification.

Now what do we at GIZ do about the topic of product uses of energy? Together with our partners in the countries where GIZ is working we are working on mainstreaming the topic of promoting Productive Uses of Energy in energy access interventions. We are gathering experiences from projects in the field and feed that knowledge back into our work on the international agenda and international wellbeing. And we are developing or have developed a set of tools and guidelines on promoting productive uses in energy access interventions and supporting microenterprises on monitoring on specific technologies such as appliances that are done on direct current and solar powered irrigation systems, cooling, and also specific energy sources.

Now let me take you through them one by one starting with a few publications specifically aiming at how to promote Productive Uses of Energy and how to support micro-entrepreneurs in setting up their businesses. The first publication may be known to a number of you as it was published back in 2011. The *PRODUSE Manual* provides a structures approach towards Productive Use promotion, which can be applied to a wide range of energy project settings.

The manual offers a step by step modular guide on how to plan, design, and implement activities to boost entrepreneurship in energy projects. And it takes the reader through each project phase explaining the important practical task for that particular phase, the expected outcomes and also providing further reading material as well as useful tools to apply at each state of the project. The authors of the *Manual* assumed a scenario whereby the Productive Use activities complement an ongoing grid electrification program. And they assume that the beneficiaries are electricity illiterate.

More recently we wanted to shift our focus and analyze options also for off-grid settings and solar photovoltaics as a suitable energy source for micro-entrepreneurship. As we are witnessing a wave of innovations in the off-grid appliances markets we decide to compile an overview of existing technologies and appliances running on direct current that are suitable for the most _____ types of micro, small, and medium sized enterprises in the rural off-grid setting.

What we found together with _____ _____ who supported us as an external consultant during this assignment turned out to be more voluminous that we

had expected initially. Actually we wanted to produce a guidebook for manufacturers and project practitioners. And the book was to highlight factors that need to be taken into account upon purchase of the appliance such as special reliable brands, features, and the availability of spare parts. Essentially though in the end the guidebook turned out to be a catalog comprising more than 140 fact sheets for individual applications including technical specifications of the appliances themselves and the required PV systems, information on the status of market development, and the availability of the appliance as well as information on manufacturers and distribution chains.

We had wanted to include exemplary calculations and costings for business scenarios but we found out and had to learn along the way that we know much too little at this point in time about business cases. So in the first half the catalog is structured according to the individual steps in the agricultural value chain, starting with livestock breeding. There we presented fact sheets about appliances for poultry farming, _____, and solar fences, then moving on to food production comprising surface pump, submersible pumps, pumping inverters.

And moving on to food processing we have fact sheets on creamers, _____, _____, huskers, graders, _____, oil presses, to food storage and refrigerators, freezers, and walk-in cold rooms and food for sale as we have a few fact sheets on butter makers, kettles, a microwave running on DC, and a coffeemaker. And then the second half of the catalog looks at options for handicraft such as tailoring or workshop tools and also the service sector. So any appliance suitable for IT, secretarial services, TVs, radios, charging sets, hair cutting, and laundry services.

Each of the chapters start with some background information on the status of technology development and why further progress is needed in this sector. And then it links to further reading material. And then after those introductory paragraphs the fact sheets follow. They provide a brief description about the product which we in most cases took directly from the manufacturers and technical specifications as I already mentioned if available information on costs.

However, we had to learn that not all manufacturers of course were willing to share price information and then also if available information on the status of technology and market development. And the very final part of the catalog we summarize a few points that are important to bear in mind when designing a business case as well as examples of successful business cases from the field. And then in that part we also linked to a business plan calculator, which is an Excel-based simulation tool for micro businesses.

Caspar will now briefly introduce you to the calculator and I'll work on agriculture applications and then I'll be back with you.

Caspar Priesemann Thank you Monika. So to just recap basically what Ana was saying earlier on is we've seen in the past that many Productive Use appliances have been pushed and supported with a lot of external support. And what we see now with the development of technology, with the drop in prices of PV, this is not

necessary anymore in the off-grid area. We see that with the applications that we have today and which are partly complied in the catalog for example on the DC range there can be really a wide range of businesses.

However, before we want to promote these businesses in the field we of course need to know will the entrepreneur be able to make a profitable business based on the application. And this is what we built this tool for. It's basically a mini business plan calculator. And it allows you to conduct a very rough calculation of a business plan. One of the nice things it offers you is along the process you are guided through key questions which you need to answer when you estimate the profitability of a business, i.e. the main and secondary products or services that could be offered, the income that you can expect on a weak, a stable, or a strong scenario, and then your fixed and variable expenditures which crucially also include your equipment that you need to invest in.

So basically with this tool we want to provide practitioners in the field with a practical tool to engage into advisory services for income generating activities. And it can work nicely together with the catalog because then you can use them in combination, but not only use any information that you can collect on the ground to check whether the specific business opportunities are worth to pursue or not. You can find the tool in the link, which is on the slide and they will be shared as well afterwards. We are open for any questions and also would be curious for feedback.

So next and also linking to what Ana said agricultural applications are crucial and specifically in the rural areas when we come to talk about productive uses. So what we did is we looked into two applications that we see as specifically relevant. And these are pumping for irrigation purposes and cooling. So firstly just very briefly what we did together with our friends at Powering Agriculture is a two-step project on solar powered irrigation systems.

This concludes a study and a menu. Firstly the study aims at analyzing the status quo of the technology, the economy of it, and the impacts. We're set to finalize by this fall and there are some quite interesting findings on the potential application of this technology, again with today's options and price levels, which have vastly expanded the potential use of this technology. However a crucial finding was that the market for SPIS will not develop by itself.

So skills are needed and this is on all levels including the farmers who use the technology, but also the banks and MFI who finance, and then businesses who offer the technology, install, and maintain them. So this is tackled by the menu which is covering a wide range of guidelines and tools that help you to provide assistance in that sector.

Then on cold chains for perishable foods, also mentioned before already as high potential area. So we see that there is a tremendous potential for reducing food losses and improving employment opportunities along the refrigeration chain for perishable food products. What we did in this

landscape study is we checked the cold chains, how they are set up in low against high income countries. We identified the cooling needs along three product categories. And then we summarized a few technological options for cooling and identified options how these cooling needs can be supplied with renewable energy.

There is just one point I'd like to stress before handing back to Monika. We see that many interventions on cooling of agriculture products now focus on one spot alone along the cold chain. However we find that it's very crucial that if the benefits are truly reaped then the entire cold chain from the production to consumption needs to be covered. We did this study together with colleagues from pro clima who propose a set of technologies that are climate friendly and with renewable energies the advantages on one point along the cold chains can be extended to cover ideally an entire range from production to the consumption that you see here sketched in this diagram below.

I'll now hand it back to Monika. Thanks.

Monika Rammelt All right. And I'm going to continue with a publication that deals with productive uses of thermal energy. For those of you working improved access to thermal energy for cooking, heating, drying, baking, smoking, and other productive uses that do not require electricity you can have a look at our overview study that deals with existing technologies and conventional production processes in agricultural, industrial, and commercial sectors.

The guidebook provides technology and product examples for improved cooking technologies, baking ovens, but also solar driers, smokers, and cooling facilities. Now moving on to tools for monitoring and evaluation, as Ana already pointed out in her presentation providing evidence for a link between electricity access and economic growth as well as poverty reduction it's not easy and requires thorough quantitative research that is in many cases much too costly and time consuming for project practitioners.

Businesses that get electrified can per se be different to those that do not get electrified and hence a simple comparison of these two groups can be to envelop findings. Therefore proper usage of statistical techniques is necessary as well as sufficient sample size. So back in 2009 GIZ together with World Bank ESMAP and the African Electrification Initiative initiated a research project on economic impacts of electrification programs in Sub-Saharan Africa.

As in many cases where implementing agencies are assigning consultants for an impact study the budget was limited. But expectations were higher regarding the methodological approach and statistical rigor of the study. So the consultants developed a robust and sound evaluation yet cost-effective evaluation method for energy interventions with the focus on impacts for micro, small, and medium enterprises. The methodology includes three modules: short SME survey, and extended and profound SME survey, and anecdotal case studies.

We would like to encourage others to make use of this method to fill the persisting knowledge gaps on the links between local economic growth and energy access. Under the link provided above you can access sample terms of reference, the various survey forms, and also code sheets for analyzing the collected data. We applied this methodology for what we call the Produse Study. This is a quantitative analysis of impacts of electrification on farmers in Benin, micro, small, and medium enterprises in light industrial zones in Ghana and fishing communities in Uganda.

The study found that mostly businesses in the service sector tend to get connected to the grid but take upgrades in the manufacturing sector for all areas were surprisingly low. Also except for the case study in Ghana which looked at enterprises in light industrial zones specifically the usage of electric and appliances for economic purposes was low. And electricity was rather used for lighting. And although the consultants found evidence that electrification can lead to the creation of new businesses which generate additional income and attract larger enterprises to the area of electrification in Benin they found that electrification hardly translated into higher profits for already existing enterprises.

And instead could even reduce their profitability. We are currently working on a study applying the same methodology yet again in a community based grid electrification program in rural Nepal but we're currently still discussing the findings and analyzing the data. We are expecting the study to be finalized in about two months from now. We would be happy to engage in an exchange with other project practitioners who have come to similar observations. And in order to facilitate this exchange we would now like to make you aware of two internet based platforms on Productive Uses of Energy.

Firstly the PRODUSE website which contains all the publications we talked about during the presentation including a list of further reading materials and project examples. And then also the Productive Use portal on Energypedia. It's wiki-based so all of you are invited to write articles and contribute to the knowledge base and also the boost the exchange on people working on Productive Uses of Energy.

With this we would like to end our presentation. Here is an overview of links to everything that we presented. We're looking forward to your feedback and continued exchange on the matter. Thank you.

Eric Lockhart Thank you Monika. We'll switch over to Dr. Butch Gadde now. And Butch it looks like perhaps your microphone may be muted.

Butch Gadde Oh yes that's correct.

Eric Lockhart There we go. And also we don't yet see your slides. There should be a pop up for you to share your screen.

Butch Gadde Is it now?

Eric Lockhart Not yet. We can hear you but we can't see your slides quite yet. There we go. If you could full-screen your slides then we'll be all set. But we see them now.

Butch Gadde Okay, all right.

Eric Lockhart The slides are not yet full-screen but we do see your screen now. We can see the dashboard on the right-hand side. There that's perfect. Wonderful, all set.

Butch Gadde Okay good. Sorry for the technical glitch. Hello attendees of this webinar. Thank you very much Monika and we are glad to present along with IDS and GIZ off our EnergyPlus Guidelines that UNDP developed. And we also would like to thank Clean Energy Solutions Center for providing us this opportunity.

As part of the energy access status update as most of attendees may be aware of this slide, must've seen before, the global energy access deficient in 2012 was an estimate 1.1 billion. This constitutes roughly 15 percent of the global population. And 2.9 billion did not have access to improved cooking facilities equal then to 41 percent of the global population in 2012. About 84 percent of these people live in rural areas and about one-third in Sub-Saharan Africa and developing Asia.

Most of the world's nearly three billion people who lack access to electricity or improved cooking facilities live in Sub-Saharan Africa and developing Asia and they live in poverty. Expanding the energy access therefore should aim at poverty eradication. As Ana pointed out traditional energy access programs used to focus on providing energy carriers. In a sense biomass, petrol, diesel, coal, and natural gas are _____ _____ for example.

And technologies and services without considering how this access can be used in a sustainable manner and to promote wider development benefits. The energy technologies, for example this renewable energy solutions and services such as lighting, cooking, space heating, refrigeration, and other mechanical energy needs. But provided electrical energy is not enough by itself to lift people up from poverty. Equally important is going beyond basic energy need to ensure the employment of the poor—both women and men—to use modern energy in ways that benefit themselves and their communities as a whole.

UNDP has been promoting the approach of energy access for productive uses since 2011. UNDP considered the EnergyPlus approach, put simply EnergyPlus is Energy Access + Empowerment as it detailed up there. EnergyPlus combined energy services with non-energy interventions that aim to improve livelihood, generate jobs, create enterprise opportunities, improve access to education, and health, and enhance agriculture productivity as some of the applications that Monika pointed out in their tool.

Let us look at the link between energy human development and poverty reduction. Productive Use of Energy includes meeting social needs such as energy for schools, public services, and health clinics to improve the quality

of medical services and enhanced education standards. Energy services must be coupled with interventions to expand livelihood capacities, generate employment opportunities, and other development outcomes.

Ensuring productive uses of newly accessed energy at household, community, and enterprise level can thereby contribute to sustainable human development and poverty _____ reduction. UNDP recognizes that communities and nations are more resilient and likely to achieve sustainable growth when the voice of all women and men are equally heard regardless of income levels, status, ethnicity, disability, and _____ status.

For that gender equality and the employment of women are at the heart of UNDP's development mandate and are integrated into all development products, especially energy related. It therefore brings out important results that ultimately contribute to not only poverty reduction but also to broader sustainable human development. The EnergyPlus guidelines of UNDP were written for policy makers, both national and local government officials, development practitioners, civil society organization, research institutions, and commercial enterprises.

These have been designed to assist in promote improved energy access and providing guidance on planning, designing, and implementing and EnergyPlus program and _____ projects. The guidelines adopt an approached based on many years of UNDP's analysis on energy access experiences which have helped _____ important components of an effective energy plus program and _____ selection of useful implementing options including additional selective difference material which you can see towards the end of my presentation as well.

Most importantly the guidelines aim to contribute to the UN's 2030 agenda for sustainable development and two key global initiatives: the Sustainable Energy of All initiative that was launched by UN Secretary General Ban Ki-moon in 2011 and ongoing advocacy campaign of Decade of Sustainable Energy for All which was from 2014 to 2024. SDGs are closely—SDG 7 especially is closely linked with an impacts—a range of other SDGs—particularly SDG 11 on poverty, 5 on gender equality, 6 on sustainable water and sanitation.

SDG 8 on inclusive growth, 9 on inclusive and sustainable industry _____, 11 on sustainable cities, 12 on responsible consumption and production, and 13 on climate change. As you can see it could happen right at impact on different types of goals as well. The guidelines provide an overview for _____ options and actions, advise on planning, designing, and implementing, and guidance on how to engage energy and non-energy practitioners and partners through seven guiding components which I'll be walking you through.

As you can see here the rows reflect rules that need to be _____ by nation, government, and industry stakeholders—local governments as well. And in the columns you can see type of capacity that needs to be built. This provides a start to an end kind of an approach through these seven components. The guidelines address structured—along as I mentioned level of stakeholders

involved, national or local, and type of capacities needed to address the capacity of stakeholders to make informed decisions about energy access supply and use.

The capacity to drive change through leadership and coordination, and the capacity for energy markets to ably serve the poor. There are seven—there are a number of projects which were designed using these EnergyPlus guidelines within UNDP. But I'd like to bring to your attention five selected projects that are currently under implementation as we speak. The first one is on Renewable Energy for Rural Livelihoods in Nepal.

The second one is in Timor-Leste. The third one is a _____ modality approach in Sri Lanka. Then the fourth one is in India, which is Scale Up of Access to Clean Energy. And the fifth one is on Sustainable Energy Solutions in DPR Korea. And all these projects use an end-to-end approach of these components. And then there is some kind of an issue that is addressed or a specific component is already addressed in a previous project then we don't repeat that.

And we will take lessons forward from there. This particular objective of Renewable Energy for Rural Livelihoods in Nepal is to increase utilization of renewable energy resource in rural Nepal in order to support that we make environmental and social development. I won't read through and I'm sorry for the dense text here. But you could just follow me. And the main gist of telling this particular—or mentioning of this particular project is—this project was built on the experiences from its predecessor project called Rural Energy Development Program—REDP—which is very familiarly known in the region.

And this has a real integrated element of empowerment. And how a well-designed integrated project could make such kind of an impact. And as you could see the follow on project is RERL, which starts producing a greater good in results. It's more than expected. Here in this specific project we didn't go back into capturing the baseline situation because IEDP established a firm baseline and therefore we've taken from the institutional arrangements and onto the other related elements that I mentioned here. For example I mentioned support, resource, and demand mapping, Productive Use interventions, energy production and distribution and scale up as well.

The objective of the project: Promoting Sustainable Bio-energy Production from Biomass in Timor-Leste is to sustainable production and utilization of biomass resources in Timor-Leste using the application of biomass energy technologies, mainly to improving cook styles. And here in this specific project the project captured the baseline in terms of where we stand with regard to the promotion of the cook styles. And also revive the institutional arrangements when it comes to the improved cook styles.

And there is a financing modality integrated. We didn't go for much of a resource and demand mapping exercise here, then went on to the corrective use interventions mainly for production and distribution of cook styles as part of the energy production and distribution. And we expect with all these key

elements this project can be taken in most scale up and replication modes across the country.

The objective of the Appropriate Mitigation Actions in the Energy Generation and End Use Sectors in Sri Lanka it mainly uses the modality of NAMA to support appropriate climate change mitigation actions in energy generation and end use sectors. And I won't read the progress so far that has been achieved but it uses end to end like all the seven components were revisited. And especially this is most needed when we're going to the subnational level especially provincial level in terms of biogas-digesters, solar PV, and high efficiency motors promotion.

And also this particular project produced Marginal Abatement Cost Curve tool and developed this one for all the 15 pre-identified options as well. Among those selected few _____ for example biogas-digesters, solar PV, and high efficiency motors.

The objection of Scale Up of Access to Clean Energy for Rural Productive Uses in India—the particular project was built on access to clean energy. And we took it under global environmental facility assistance. We took it into more of a scale up mode. The beauty of this project is it also integrates seven components of the EnergyPlus guideline. As for _____ it also integrates heavily anchors with the rural livelihoods mission. And as Ana pointed out very much we can't just expect energy solutions and linking with some of kind of an intervention.

And we can't expect the markets to grow. But there are linkages that need to be done. And what kind of livelihood related activities that we are looking at—what are the targeted sectors here? We looked into poultry, fisheries, dairy and horticulture and khadi industries like silk weaving, bamboo, and commercial cooking. And how each of these particular livelihood sectors, the technologists could make an intervention in terms of reduced use of conventional energy or other types of fossil fuel energy replaced with renewable energy.

And this is also one of the projects which has significantly—which is expected to be taken into more of a scale up and duplication mode simply because it combines with various missions. And take it to the—we hope actually it would take it to the next level in the program.

The objective of Sustainable Energy Solutions Project in DPR Korea is to provide rural communities with adequate, secure, and reliable access to renewable energy resources. The project simply—I mean this particular project did not use the financial support and market incentives at the moment because there are no simply existing such markets here. But nonetheless we are capturing the baseline and we device energy demand and resource assessment studies, getting the first time baseline information on the ground with regard to the current energy use and demand patterns.

And we are also working with subnational institutions like county committees and _____ committees in terms of resource and demand mapping as well as

productive interventions. And this project focuses on both renewable energy and energy efficiency. And we expect this one to be replicated in other villages as well. At the moment we are working in 15 villages, which is expected to be taken to more scale up and duplication in more.

In conclusion EnergyPlus approach fully complements basic energy services at every step with key energy interventions designed to enable Productive Use application. Then _____ energy value chain and productive use value chain then ultimately it results in the achievement of EnergyPlus outcomes. We believe that the EnergyPlus approach combined—embodied in these guidelines offer the greatest opportunity for taking forward the 2030 agenda for sustainable _____ as well as contribute to the future we want under the Decade of Sustainable Energy for All. That's from 2014 to 2024.

I'd like to thank you and I would like to end here. But I'm sure the organizers would like to share all the slides later where you can see each component, what are the additional selected resources. For each component we list out additional resource material. These are specifically selected but you're welcome, if any of the attendees who have great additions in terms of taking some of the interesting rules and concepts. Thank you very much. Back to you Eric.

Eric Lockhart Wonderful. Thank you very much. Thank you to each of the panelists for those outstanding presentations. We'll switch over to the question and answer session at this stage. Before going to the first question I just want to remind all the attendees to please feel free to type questions into the question pane. We have a few great questions coming in already.

The first question is about Productive Uses of Energy. It was asked during Monika's presentation and I'm sure all three panelists would have plenty to add to this one. The attendee asks if you could speak a little bit more to relevant challenges and barriers, and specifically asks about three challenges. One, being awareness and education, two being appropriateness of technology, and three being role that exclusive relationships with different private sector actors might play in making projects be more financially viable.

I'm happy to repeat any part of those. Please feel free to jump in—any of the panelists. The question is about primary challenges—excuse me a little bit more about challenges, Productive Uses of Energy, either in an education exclusive dealership relationship or the *[audio cuts out]* of technology.

Butch Gadde Let me make an intervention here with regard to the challenges for Productive Uses of Energy especially before Monika addresses. But I'd like to just jump in. The involvement of the private sector is quite critical and crucial. And most often these are public services and public purposes where the revenues of _____ are quite low as Ana pointe out in her presentation. These are not quite attractive for private sector involvement and therefore we could not be able to take it to the larger or broader scale up and replication mode.

These are mainly as of now like government supported or heavily subsidized kind of modality we are operating in.

Eric Lockhart Monika, were you hoping to add to that?

Monika Rammelt Yes I wanted to add a few points to that regarding the challenges and barriers for Productive Uses in rural settings. As Butch just mentioned I mean we are operating in rural remote areas. The level of education and the level of financial literacy in the areas that we are operating is generally low. So what we really need to do is work on the business skills together with interested and able entrepreneurs in the regions. And then also as Ana rightly pointed out once we have a certain segment or a certain mass of people interested in opening up new businesses once access to energy is gained we face yet another set of challenges.

That is access to markets and consumers, the availability of equipment of good quality, and then again the availability of technicians that can maintain the equipment. And also the access tool to finance and to find banks and microfinancing situations that are ready to give you _____. Although the business that you are about to open up has never been seen in that area before. So those are some of the challenges that I wanted to add there.

Eric Lockhart Great, thank you. All right a quick—Go ahead Ana.

Ana Pueyo Can I add just a little thing? So with regards to challenges we've seen that access to markets, as I said before, is what most of the respondents identify as their main constraint. And in particular access to roads that gives them access to markets are *[inaudible comment]*. We also find education. So we're looking at integrated development programs that include electricity. There is thought to be a big, big synergy with programs that include improved infrastructure like roads and education and electricity.

So this is one thing. And with regards to the appropriateness of technologies what we saw in our visits to different communities is that very often these communities don't need more than what can be provided by small solutions like those provided in Kenya by M-KOPA. It's like a small solar system. Often they only need light and mobile phones to start with. And these are very cheap solutions that they can pay with their mobiles little by little. Often they only need that to start with as they learn how to use electricity in different ways.

So sometimes when they are provided with a bigger solution that is more expensive it drains their business. They just don't have enough production to pay for it. So it can be more clever just to see how much power they need and start with small solutions.

Eric Lockhart Great thank you. The next question is about cost recovery and if the panelists could speak a little bit more about how cost recovery for off-grid solutions can work and how it can be inclusive of all categories of households.

Butch Gadde Yeah maybe I can say a few words on that because it was partially also a bit of the logic that we tried to cover with the business plan calculator. Of course what we're faced with in the rural areas especially since we want to also alleviate poverty is that the technologies that we want to bring into

application even though the prices have fallen significantly are still very expensive. So in terms of cost recovery I would say the most important—and this also I can completely underscore what Ana says.

Access to markets is a crucial element. Whatever you do as an entrepreneur needs to be profitable if you take out all kinds of subsidies. So if you invest into your technology, if you are able either if you have saved up the money to spend the necessary hardware to start a business. Or you are able—which is another huge challenge—to take out a loan. Then you need to see that at the end of the day you make a profit or you earn enough money to recover the costs that you spend on investing into your business with whichever application we're talking about.

So we see this. Cost recovery is really—especially when we talk about scaling particular applications it's a crucial element. Of course it's not the only one. You also need to have for example even already the availability of high quality products and as was mentioned the financial aspect that you are even able to gather the funds. But when it comes to recovering the costs when we talk Productive Use of Energy then the fundamental part is that at the end of the day you have more income than expenditure which is quite clear, quite logic.

But in the end, especially when we come to promoting productive uses, and also quite complex because we are often working with new businesses we don't know the cash flows. We need to sometimes work on assumptions. So we have a lot of big questions marks. But this is also where at the end of the day we see either technologies that fly or others that just don't really pick up.

Eric Lockhart Great, thank you very much. The next question also is in a similar vein talking about off-grid solutions and micro-grid specifically. One attendee is asking what the impact might be of larger grids—so 100+ kilowatts and if folks have looked at that and what the barriers might be there, or opportunities as well?

Ana Pueyo All right is this the impact of larger grids as compared to smaller grids?

Eric Lockhart That's right. It was actually asked during your presentation Ana when you mentioned five kilowatt grids. An attendee was wondering if you had looked at larger grids.

Ana Pueyo Yeah I haven't looked at larger grids. We are focusing on really small, rural areas. Yeah I cannot tell you what the difference is. Of course there would be many more uses and it's easier just to balance the load when there are more uses. But I haven't done a study about that. Can I go back to the previous question? I don't know with regards to the cost recovery because what we are—A very short note. It maybe is irrelevant for the bigger _____ _____.

But we are seeing that because developers have to pay such massive debt—they have to pay a very high cost for the debt and their equity. They also need to have very short maturities. They need to have very short payback periods. So they need to charge quite high fees at least for the first five years. But it

can be expected that after this big debt is paid prices could go down in the future. So a big element of cost recovery is the massive cost of finance the developers have to pay.

So this is an important intervention that could be done by donors or by organizations like UNDP and others.

Eric Lockhart Thank you Ana. That's a great addition to the cost recovery piece. Butch or Monika would you like to add anything to the question of larger grids, specifically perhaps what business impacts there might be of a slightly larger system.

Butch Gadde Sure we can add a bit on that. The tool that we developed, we've been working a lot with our consultant Robert Schultz. And actually one of the key arguments that he often proposes, which I think fits well here is that when you look into rural electrification historically what we see is that people have a centered approach of building grids—many grids now—on the number of households. And they see that there are a large number of households, maybe even not very disbursed.

Then that makes a case for a larger mini-grid. Neglecting the number of Productive Uses and types of Productive Uses. Now what Robert said is that we need to reverse this and really look at the number of productive uses because specifically when we talk about the technology for photovoltaics we have a large energy surplus during the day. So the cost of storage is quite significant. And the load profile of households clearly is more towards the morning and the evenings while Productive Use is offered opportunity and this is not crucially something where project developers of mini-grids should take really much more care when they develop the systems.

Productive uses can, as Monika said in the presentation, offer a kind of baseload. They can take up a lot of the consumption during the day. So I mean I guess all of the audience is familiar with the ABC model which is pretty much also underlining this idea that if you're developing a grid and you have an anchor client then you're much more likely to recoup your investment to have positive cash flows then if you have a multitude of household consumers which had very erratic and sometimes very changing demand profiles.

This is especially when you talk about larger grids which are to some extent needed when you have a larger number of Productive Uses I would say really do take into consideration what kind of productive uses you have on the spot and do center your system around these key clients rather than focusing on the households.

Eric Lockhart Fantastic. Thank you. Just a note that there are still a number of questions coming in. And for those that we don't get to we will make connections via e-mail for unanswered questions. The next question is if any of the panelists could speak to if there are considerations for linking off-grid solutions to the national grid down the line. Let's say if you implement an off-grid solution

and the national grid is extended to where that off-grid solution was sort of what the next steps would be and considerations.

Butch Gadde Let me try to address this question. This is quite an important and very, very valid question. What happens to the off-grids when there is a grid nearby or a national grid comes up in that region? This issue was faced in some of the projects. And the main important point is that there are issues with regard to the interlinkage of smaller grids, of micro-grids with a national grid. There are rules and procedures in each country. And we need to understand thoroughly the country context very much.

The second challenge is with regard to the connection of this off-grid to the on-grid the off-grid must be qualifying to some standards, or some national standards or some kind of an international standard if it is possible so that the interconnection would be much easier irrespective—I mean to bring the policy related aspects or principles in a country. But the type of standard of quality of this off-grid must be to the standard.

And quite often in cases we have noticed that these are very poor quality mini-grids and these are not allowed to be connected to the—interconnected with the national grid. If that is the case then we have to revisit in case of additional investments are needed during the initial investment itself of the off-grid. We have to factor into those costs into account.

Eric Lockhart Great. Thank you very much.

Ana Pueyo May I add something?

Eric Lockhart Absolutely.

Ana Pueyo Okay. Yeah this question is very relevant because it comes up all the time. What will happen to this when the grid arrives is the main risk that most investors in mini-grids fear. So the key answer is regulation. There has to be clear regulation on what happens when the grid arrives. And there has to be integrated on-grid and off-grid planning. So when we talk about regulation, regulation should cover both things mainly. First, what happens to the assets like what happens to asset ownership?

What should be the rules like if the national utility wants to buy the assets and how much they should pay for it? Or if their project owner doesn't want to sell it then how they can come to an agreement for them to get the _____ that help them to recovery their costs. So both of these issues should be clearly stated in regulation. And I think a good example in Africa is Uganda. It's taken us a good case for many other countries that are looking at implementing clear regulations and linking mini-grids to the national grid.

What we see as well is that _____ is that while often people say, "We should ask every mini-grid to get a permit. It has to be grid compatible." And that will ensure that they can be integrated in the grid. But then when you talk to project developers they say that this will add a lot to the cost of the mini-grids. So it could make them even more unaffordable for communities,

especially if they don't have clarity on when the grid is going to arrive. They don't know if it's worth it to make the investment to make them grid compatible to be according to the national grid code of the country.

So these other _____ issues to have clear regulation and to look at the tradeoffs of having grid compatible mini-grids and also having affordable mini-grids.

Eric Lockhart

Wonderful. Thank you very much. Thank you to all the panelists for those great presentations and for answering those questions. Before turning to the survey I wanted to just quickly offer brief closing comments if any of the panelists would like to make any closing statements before we turn to the survey.

It sounds like we covered all the big issues then. We'll go ahead and turn over to the survey now. We have five questions that will show up on the screen. Thank you again for those panelists. Those were fantastic presentations.

The first question is: the webinar content provided me with useful information and insight.

The next question: the webinar's presenters were effective.

Overall, the webinar met my expectations.

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 revise policies or programs in your country of focus?

Thank you for answering our survey. On behalf of the Clean Energy Solutions Center I'd like to extend a thank you to all of our expert panelists and to our attendees for participating in today's webinar. We'd had a terrific audience and we very much appreciate your time. I invite our attendees to check the Solutions Center website if you'd like to view the slides and listen to a recording of today's presentations as well as previously held webinars.

Additionally you will find information on upcoming webinars and other training events. We are not posting webinar recordings to the Clean Energy Solutions Centers' YouTube channel. Please allow for about a week for the audio recording to be posted. We also invite you to inform your colleagues and those in your networks about Solutions Center resources and services including no-cost policy support.

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