CLEAN ENERGY SOLUTIONS CENTER
ASSISTING COUNTRIES WITH CLEAN ENERGY POLICY

State of the Off-Grid Appliance Market: Connecting the Data on Market Trends, Jobs, and SDG 7

—Transcript of a webinar offered by the Clean Energy Solutions Center on 24 September 2019—
For more information, see the clean energy policy trainings offered by the Solutions Center.

Webinar Panelists

Michael Tsan	Dalberg
Kiran Willmot	Dalberg
Jenny Corry Smith	CLASP
Naomi Bruck	Lighting Global IFC
Rebekah Shirley	Power for All
Silvia Francioso	GOGLA
Lindsay Caldwell Umalla	World Bank Group

Presenter Name	Presenter Affiliation

This Transcript — Because this transcript was created using transcription software, the content it contains might not precisely represent the audio content of the webinar. If you have questions about the content of the transcript, please contact us or refer to the actual webinar recording.

Kamyria Coney — Good morning, everyone. I am Kamyria Coney, and welcome to today's webinar, which is hosted by the Clean Energy Solution in Partnership with Efficiency for Access Coalition. Today's webinar is focused on The State of Off-Grid Appliance Market: Connecting to the Data on Market Trends, Jobs, and SDG 7. All right. Before we begin, I'll quickly go over some 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, please phone in by selecting the telephone option, and a box on the right side will display the telephone number and audio PIN you should use to dial in. If anyone is having any technical difficulties with this webinar, you may contact the GoToWebinar's help desk at 888-259-3826 for assistance. If you'd like to ask a question, we will have you use the questions pane where you will type in your question. The audio recording and presentations will also be posted on the Solutions Center Training Page within a few days of the broadcast, and we will also add this to the Solution's

Center YouTube channel where you'll be able to find other informative webinars as well as video interviews with thought leaders on clean energy policy topics.

Finally, 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 of one of many best practice resources reviewed and selected by technical experts. Today's webinar agenda centers around presentations from [inaudible] presenters. Michael, Natalie, and Kiran discussing SOGAM household and SWP supplement plus ISD polls, followed by our expert panelists Jenny, Silvia, Dr. Rebekah, Naomi, and Lindsay. [Inaudible] all panels will discuss powering jobs work as it's related to this SOGA—excuse me—SOGAM and PULSE findings on the GOGLA panelists that will discuss the data collection efforts and how it [inaudible] into reports like this that we're discussing today.

In addition, Jenny will also be our moderator today, helping us with questions for our expert panelists. Before we go ahead and go into our presentations, I would like to talk to you about our Clean Energy Solutions Center and what that entails, and then we will continue on with our presenters. The Solutions Center was launched in 2011 under the Clean Energy Ministerial. The Clean Energy Ministerial is a high-level global form to promote policies and programs that advance clean energy technology to share lessons learned and best practices, and to encourage the transition to global energy economy. Twenty-four countries and the European Commission are members, contributing 90 percent of energy investment and responsible for 75 percent of global greenhouse gas emissions.

This webinar is provided by the Clean Energy Solutions Center, which is an initiative of the Clean Energy Ministerial. The Solutions Center focuses on helping government policies design and adopt policies and programs that support the deployment of clean energy technologies. This is accomplished through access to no-cost expert policy assistance and capacity building activities such as this webinar. The Clean Energy Solutions Center is co-sponsored by the governments of Australia and the United States. The Solutions Center provides [inaudible] clean energy policy programs and services, including a team of over 60 global experts that provide remote and in-person technical assistance for governments and government supported institutions. A no-cost virtual webinar trainings on a variety of clean energy topics, partnership building with development agencies, and regional and global organizations to deliver support, an online library containing over 3,500 clean energy policy related publications, tools, videos, and other resources.

Our primary audience is made up of energy policy makers and analysts from governments and technical organizations in all countries. But we also strive to engage with private sector, NGOs, and civil society. The Solutions Centers is an international initiative that works with more than 35 international partners across a suite of different programs. Several of the partners are listed above and include research organizations like IRENA and IEA programs like

SEforALL and regional focus entities such as the ECOWAS Center for Renewable Energy and Energy Efficiency.

A marquee feature of the Solutions Center provides is the no-cost expert policy assistance known as Ask An Expert. The Ask an Expert service matches policy makers with more than 60 global experts selected as authoritative leaders on specific clean energy finance and policy topics. The assistance is provided free of charge, and if you have questions for our experts, please submit it through our simple online forum at cleanenergysolutions.org/expert. We also invite you to spread the word about this service to those in your networks and organizations.

This webinar is an activity of the Distributed Rural Energy Data Network in partnership with the [inaudible] for access. Increase interest in and availability of the centralized renewable electrification technologies [inaudible] of new opportunities to learn about their impact. However, currently, researchers and stakeholders operating in or exploring this sector do not have current and easy way of learning about the latest research or to search/share their own findings, needs, and experience leading across over in efforts and a lack of awareness as important research gaps results in learnings.

We will also have a resources slide at the end of this webinar so you can learn more about this awesome collection of researchers. Next is the Efficiency for Access. They are a global coalition promoting energy efficiency as potent catalysts in clean energy access efforts. Since its founding in 2015, Efficiency for Access has grown from a year-long call to action in a collaborated effort by global leap and sustainable energy for all to coalition of 14 donor organizations. Again, we can find more information on the resources list at the end of this webinar. We're going to go ahead and introduce our first presenters of this webinar.

First we have Michael Tsan who is our partner with Dalberg. Michael is a partner who splits his time between the US and Africa and co-leads Dalberg's global energy practice. Michael is a leading expert on off-grid energy access, markets in the developing world, and has spent the past decade working in Sub-Saharan Africa, South and Southeast Asia, and Latin America. Next is Natalie Hudson. Natalie is a project manager with Dalberg's Nairobi office focusing in the inclusive business practice area, and worked the African continent. Her expertise is in business, models, serving rural customers, notably in the nutrition, agriculture, finance and energy spaces.

And finally, we have Kiran Wilmot. He is a project manager at Dalberg, leading consulting teams and complex analysis that drives Dalberg's strategy, work for multi-lateral corporate clients, foundations, utility companies, and NGOs. Kiran's work has focused on strategic planning for new initiatives, investment appraisal, private sector development, market intrigue strategy, and program delivery across the energy water infrastructure and agriculture sectors. So at this time, I will turn this over to Michael, Natalie, and Kiran to present.

Michael Tsan Thank you very much, Kamyria. Good morning everyone. So we'll start—we'll have three quick presentations. The first of these is on the state of the off-grid appliance market report, which CLASP and Dalberg are launching under the efficiency for access coalition. Right now—and some of you may have seen some earlier versions of this, but this is a formal launch of the report. So I'm going to take about 15 to 20 minutes to quickly go through the findings, and then I'm going to hand over to my colleagues to take us through a companion piece that we have done on solar water pumps, and then also to talk through the work that we've done with the World Bank and IFC on productive use for energy appliances, which is a broader look at the reproductive off-grid appliances for agriculture.

So if we can go to the next page, please. So this report builds on work that CLASP and Dalberg did three years ago in publishing the first ever state of the off-grid appliance market report. That report concluded that there was significant promise in the off-grid appliance market with early movers beginning to find proof points, but that much more was needed on product innovation, supply chains, and financing. Since that report, a lot has happened in the broader off grid market and in the off-grid appliance market including a number of programs that CLASP has been leading, this data from which most notably from Global LEAP award competitions, the LEIA program, and a result based financing program for off-grid appliances.

The data from all of that is fed into this report. Next page, please. So the overall objective of this 2019 refresh report is to build on the earlier report, and to help elevate and accelerate investment and action into the off-grid appliance space by providing a refresh back base on where the sector stands and where it's going. In terms of scope, specifically we are focusing in on household appliances, and we're using televisions, fans, and refrigerators as a proxy for the broader off-grid appliance market. The reason that these three appliances have been chosen is that they are, aside from off-grid lighting appliances and smaller things like radios and phones, these are among the top most in demand appliances by households across a wide range of geographies. So the report is taking a global view, but we're focusing in on some representative markets in Africa and South Asia. So we look specifically at eight markets to illustrate out the trends that we'll be calling out in the next 15 minutes, specifically India, Myanmar, Kenya, and Uganda, Ethiopia, Nigeria, Cote d'Ivoire and Sierra Leone. Next page, please.

Just to make sure that the definitions we're using are clear, the report focuses on we're calling off-grid and weak grid appliances. These are appliances that are adapted for off-grid settings and also for weak grid settings. We're defining weak grid as weak grid households. There's households that do have access to the grid, but the quality of the grid is intermittent, and real access to electricity only comes for half the day or less. Within this overall category of weak and off-grid appliances, there are kind of two broad subcategories. One subcategory are generic off-grid appliances, and the second one are what we are calling off-grid appropriate appliances.

Off-grid appropriate appliances are the high quality efficient appliances that are intentionally designed for off-grid and weak grid users, and that tend to

have a much stronger performance profile from perspective of durability, service quality, and especially energy efficiency. They also tend to be a bit more expensive. So the report covers both. Most of our data is on off-grid appropriate appliances, which we'll talk about shortly. If you go to the next page, please.

So quite a few messages coming out of the report. I will not go through these with executive summaries here. But you'll be able to read that if you look at the report once it's posted at the end of the webinar. Next page, please. So before we go into some of the messages around demand, supply, the enabling environment, and where the sector is heading, the first important thing to highlight is the impact of off-grid household appliances. The report provides a refreshed look at the literature on impact. You probably cannot see this very clearly in the graphic because the text is quite small, but fundamentally, the household off-grid appliances have a strong impact across multiple SDGs.

The first and obviously most obvious impact is on SDG 7, on energy access because these appliances allow consumers to fully benefit from access to energy. In addition, these appliances provide the demand pull that helps build the economics and helps support the growth of the broader off-grid energy space and potentially in the future the mini-grid energy space. Beyond SDG 7, just calling out a few of the other major impact areas, there is growing evidence around impacts of these appliances on poverty, particularly when households use these appliances to generate some revenue. So this is—we have the strongest evidence around use of refrigerators to generate revenues, and also some less directly use of TVs and fans.

And those impacts can be very substantial. So for instance, when households use refrigerators, based on some data from Uganda research conducted by CLASP, we've seen the incomes of small and micro-businesses at the ground level double on a daily basis from using refrigerators in their businesses. The second major area of impact is on health where there are multiple health benefits from refrigerator spans and in particular electric cook stoves. And this spans reducing food waste and spoilage to the use of refrigerators in health clinics to the use of fans to improve quality of life and reduce the negative impacts of heat waves. And of course with electric cook stoves, display thing—traditional cooking sources, the reduction of indoor air pollution and the four million plus deaths that result from indoor air pollution. There are also impacts on education, SDG 4, on gender equality, through time property savings, SDG 5, and on jobs.

And there's now quite a bit of evidence on jobs more broadly for the off-grid space based on recent publications by [inaudible]. Next page, please. So now just hitting some highlights of the size of the opportunity. So on demand, a little bit on the supply market, dynamics and business models, product and technology trends, consumer insights, and then flipping into conditions for market growth and pathways to that growth and sort of some recommendations on the way forward. Next page, please. So first, just starting on the demand side, the first important thing to highlight is that there's a large off-grid and weak grid population, which is in many

geographies continuing to grow as grid growth lags behind population growth.

And as the quality of the grid is in many cases not improving or not improving quickly. And this large off-grid and weak grid population which we estimate at 475 million households globally at the end of 2018 is one of the foundation in the engine for off-grid appliance demand.

Those usage, the household energy consumption right now is magnitudes lower than in the developed world. So for instance, you can see that in the box at the bottom here, in US and Europe, household energy—because average household energy consumption is five or ten times greater than the average for the average household in India—10 to 20 times greater than for an average household in Nigeria, and 20 to 200 times greater than the average household in a rural Africa. You can see that reflected in current penetration rates for appliances. So as far as we know, this is the first time that someone has gone in and tried to get this data in a true cross regional basis. So on the left side here, you can see that total penetration of televisions in—we estimated total penetration of televisions in Africa, Sub-Saharan Africa, 35 percent of households. 17 percent of households have refrigerators, and the data here is patchier, so we estimate between 12 to 18 percent of households have fans.

If you compare that to India, in Asia, that's roughly half of the levels of appliance penetration in Asia, and so these are all appliances, both off grid and on grid. But if you look at rural penetration, that's where these numbers are very, very low, particularly if you compare that to almost universal penetration of televisions and refrigerators in higher income countries. You can also see the very low levels of appliance access by looking at the average number of appliances per household. So on the right side of the stage, you can see that based on household survey data in countries like the US, UK, Spain, Korea, and Japan, an average household has between 12 to 40 electric appliances.

In rural India, that's three to ten appliances, and in Sub-Saharan Africa, that's three to five appliances including mobile phones. And so when you add all that up, what that means is that just to illustrate just how striking this disparity is, that Japan with one-tenth of the people in Sub-Saharan Africa has 25 percent more refrigerators and TVs than the entire Sub-Saharan Africa region. And survey data tells us that when you ask households what they would like, people report very significant demand for appliance—for appliances, particularly televisions and refrigerators and fans. Next page, please.

So while demand is high, the ability to afford these appliances is very low. Without financing, just assuming that households are able to pay at most two months of savings for an upfront appliance purchase, you can see the contrast here between yellow and blue bars. So without financing, the market, especially for higher cost appliances like televisions, and particularly for refrigerators, essentially drops significantly or goes to almost to zero because of the high cost of such appliances. With financing, the market can be quite substantial. Next page, please.

So in the report, we talk about the total addressable market for appliances and the total obtainable market. The addressable market focuses on the subset of the off-grid and weak grid households who can afford an off-grid appliance provided that they have access to financing on typical market terms. The addressable market, you know, as you can see here, let's say roughly half of the total number of off grid and weak grid households for televisions and for fans in as roughly 15 percent of that for higher cost products like refrigerators.

The obtainable market, however, is much smaller. The obtainable market imposes additional real world constraints on demand, including consumer finance, the availability of finance, as well as physical accessibility of these households, which we proxy with their proximity to roads. Next page, please. So if you add it all up, we get to at the end of 2018, we get to a total obtainable market size of $12.6 billion which is significantly bigger than our estimate just a few years ago.

And most of this obtainable market is in South Asia and in Sub-Saharan Africa. So on the left side—sorry, right side, you can see that adds up to $3.5 billion in Sub-Saharan Africa, $7.7 billion in South Asia, or roughly a bit over $11 billion across the two regions. If you go to the next page please. So looking ahead, we've projected the growth of the addressable and most importantly the obtainable market based on population growth, based on the interest and income levels, based on trends around appliance product costs and prices, which are consistently falling over time with improved efficiency and improved economies of scale and competition in manufacturing and distribution. And finally, improvements in access to financing.

And we see the overall market growing to $25.3 billion US by 2030. Most of that is driven by TVs and refrigerators, so higher cost appliances. And this is using what I would call fairly conservative assumptions, such as very modest declines in product costs compared to what we've seen historically. So this—these numbers could look much bigger as well. Next page, please. The way this story plays out, it does look very different by market, so some markets are ready for scale. There's a large potential market. There's a mature broader upgrade solar—or mini grid sector in a few cases, and there's high ingrown access to finance, and critically strong government support.

Then the next tier of markets we're calling high potential markets where some of these conditions are not as strong, particularly government support is much more patchy, and then you have nascent markets where the market may be smaller or could still actually—the potential market has to be significant, but the level of financing access is low, and there's very little government support. So there's a nuanced story here, and then depending on which category the market falls in, the interventions will be somewhat—or should be somewhat different. Next page, please.

So just a few points on supplies. So while data is very incomplete, now for the very first time, we have at least some data on appliance sales from a survey that the Global Off-Grid Lighting Association has done earlier this year looking at sales from GOGLA members in the second half of 2018. So

that information is incomplete. Not every important player in the appliance market is a member of GOGLA, and critically not every affiliate—GOGLA affiliate has replied to this. But we are starting to get some data. Using that data and using other information from that research, we estimate that in aggregate, off-grid TV, refrigerator, and fan penetration today is roughly—somewhere in the range of five to ten million units globally.

Most of those are in Asia, particularly in Bangladesh, and the vast majority of these off-grid appliances are generic non-branded products. The branded products, which in many cases are the much more efficient off-grid appropriate appliances are probably only 10 to 30 percent of this total. If you look specifically at the GOGLA data, we have 175,000 fans, 147,000 televisions, and just 6,000 off-grid refrigerators that were sold in the second half of last year. Again, this is not a comprehensive number, and hopefully this data will improve as there is more data collection in the years to come.

The sales have grown quickly. We don't have comprehensive information across the entire sector. We do—we have self-reported growth in sales where we get numbers in the 30 to 80 percent range across these three categories of off-grid appliances, and if you compare this with data on off-grid solar home systems, particularly solar home systems that are in the 50 to 100 watt power range, or over 100 watt power, which in many cases come bundled with an appliance, particularly televisions, that segment is growing at 33 percent per each half year, so roughly 80 percent.

So we think the range of growth is quite robust. It's in that 30 percent to 80 percent at the very top end. But again, more data is needed to refine these estimates. Next page, please. So [inaudible], and we're seeing a lot more definition around business models and a lot more specialization as the sector increases in complexity and increase in maturity. In Africa, the most important player from a distribution perspective are today's vertically integrated DESCOs, particularly the pay as you go players, that are the market leaders around televisions, fans, and off-grid refrigerators. In Asia, the story is very different. Most of the products that are distributed are products from generic manufacturers, original equipment manufacturers, and are distributed through fairly small distributors. Next page, please.

So consumer financing is a major driver as we've mentioned of the sector. In East Africa, for instance, survey data suggests that 99 percent of respondents purchase their off-grid television on credit, and the most common pathways for off-grid financing are pay as you go, financing from micro-finance institutions, and some alternative financing models like installment payments. Next page, please.

There's a portfolio—flipping to some nuances around product and technology trends, actually—let's keep going. Let's go to the next page please. So just digging into the portfolio appliances, based on Global LEAP [inaudible] data, we can see a very—a few things. Number one, we can see the fact that the [inaudible] appliance ecosystem has grown quickly. So if you looked at this data say five years ago, you would see very few off-grid appliance products, and just a handful of manufacturers. So you know, three to five brand

manufacturers for each product category in 2013. In 2017, there were 11 TV manufacturers, eight fan and seven—sorry, eight refrigerator and seven off-grid fan manufacturers, quality product manufacturers across dozens of products, and we are seeing these numbers continue to grow into 2019 with the greatest round of Global LEAP Awards.

Efficiency is definitely improving, so we saw 45 percent improvement in TV efficiency just from 2014 to 2017. And we'll get the most recent numbers in the 2019 round soon. But you're still seeing a very big disparity between the average off-grid appliance and best in class appliances. So that's between 1.5—the best in class are 1.5 to three times more efficient, which suggests that there's still a lot of room even within the current technology frontier for improved efficiency, and still further technology efficiency improvements coming up. So for instance, for refrigerators—that's a typo.

For refrigerators, we think that another 50 percent efficiency improvement is possible with improved insulation materials, motors, and so forth. Alongside improved efficiency, prices are falling, particularly with TVs. We've seen a 23 percent decline in prices between 2015 and 2018, and that's on track to probably 35 to 40 percent, certainly more than 30 percent by—in the next few years. Next page, please. Quite a bit of technology innovation still happening that will drive those improvements in efficiency, improvements in quality and performance on these appliances. Not going through these in detail, but just highlighting several, such as blade design and brushless motors in the case of fans.

Improvements in luminance, innovations around—in durability, and just continuing improvement and efficiency for televisions, and the potential for much greater improvements in efficiency for refrigerators through improvements in materials, such as [inaudible] change materials, and improved controllability of these devices. Next page, please. Looking to consumer insights, the broadest point made here is that the demand as mentioned earlier, the demand for these appliances is strong. You can see here that beyond televisions, refrigerators, and fans, there's a next tier of appliances that are coming up and that are generating quite a bit of interest both from consumers and from manufacturers and distributors. And importantly, when you talk to consumers, it's clear that while affordability is still the biggest barrier and biggest driver of appliance update, beyond affordability, consumers are increasingly focused on quality, and as a result, many manufacturers and distributors are increasingly focused on consumer depth and performance.

So whether it be aesthetics, durability, or other features as that consumers prefer for a specific product. Next page. So wrapping all this up, there are a number of conditions that we highlight as being essential for supporting market growth, including financial incentives, both through the level of consumers and at the level of the overall supply chain to drive this ecosystem forward. Important conditions from perspective of policy in terms of national energy policies, taxes and tariffs, policies around mini-grid development, and policies around standards and such issues as fee waste. The need for

continuing to build consumer awareness, and the need to continue to innovate around distribution to solve the last mile distribution challenge. Next page.

[Inaudible] aware all of this is going, we do see the addressable [inaudible] obtainable market growing quite quickly. We see sales growing quickly, but we think that much much faster growth is possible if a few things happen. So the first of this is highlighted around policy. It's governments recognizing that off-grid appliances are an important part of electrification and energy access, and creating—enabling policies around off-grid appliances. From a finance perspective, it's more dedicated financing flowing towards off-grid appliances. More knowledge sharing around what works and continued investment in market intelligence. This market can be traced so we have better data. Engagement with private sector to draw more private sector players in. Along the lines of what the energy [inaudible] alliance and CLASP and others are doing. And lastly, continued investment in technology with a particular focus on efficiency and cost.

Next page, please. So that essentially takes us—and a number of specific policy and other levers for bringing down costs and improving affordability more broadly. So that takes us to the main messages of the solar off-grid report. We can now quickly turn to solar water pumps and an update on the broader productive use segment before taking questions.

Kiran Wilmot

Thanks, Mike. So yeah, just there's a transition really into probably a more emergent area of productive use appliances. As part of this [inaudible] work, we also extended the analysis to look at the solar water pumps market, and then specifically some of the nuances and requirements for growth that are additional to those that Mike just mentioned. If you just flip onto the next slide, please. So the solar water pump opportunity space is really built out of uses in agriculture, which would be irrigation and livestock, water, and then also drinking. The agricultural context is framed by if we take Sub-Saharan Africa, 95 percent of farmed land relies solely on unpredictable seasonal rainfall, 60 percent in South Asia. There's still a very large kind of requirement for better irrigation, and often in off-grid areas.

So there's a kind of synergy there with off-grid solar water pumps. And then from a technology perspective, you've got larger submersible pumps, smaller submersible pumps, the smaller areas of land, and then surface water pumps. You can see there is quite a big range in product prices currently, but they are coming down and have come down by about 80 percent in the last two decades. So with that, there's an increasing number of players that are active in the area, innovating around system technology and how to deliver clients, which means that solar water pumps could be moving towards there being competitive or viable against diesel incumbents or opening up solar irrigation where it wasn't possible before in off-grid or weak grid areas. If that were to happen, there are a lot of touch points back to sustainable development goals, including say with yield uplifts and more resilience, you can hit some poverty and hunger targets.

In terms of competition versus diesel, you've got low-carbon emissions, so hitting some SDGs 7 and 13, and then in terms of time saving and the burden

of collection of water, there's some gender related aspects as well. If you flip onto the next slide. So it became apparent through our analysis that the market is very large, but it is definitely under-penetrated currently. We focus on Sub-Saharan Africa and India. We've projected in a similar kind of methodology to the one that Mike described for off-grid appliances. A market of by 2030 of around 11—a big number. But let's just look at what's actually going on at the moment say in a reasonably progressed market, which is in India where subsidies have been used to grow the installations of solar water pumps by quite a large amount in the last five to six years, but still it only kind of scrapes the top of the water pump market with still 32 percent being diesel powered.

So and one element of that that is worth mentioning is that that was very much driven by subsidies and in future, there is obviously a view of whether those subsidies will continue in India or when they'll start to take [inaudible]. By contrast to this number here, data from 2018 suggested that solar water pump provision sales in East Africa were around 5,000 in the second half of last year. So that just gives you a kind of metric of—a very nascent—it's emerging and solar water pumps are not at the scale even of the [inaudible] and projection TVs we mentioned before. Next slide please. So important just to understand or consider a little bit about what drives demand for solar water pumps. And then also with the duty what actually a solar water pump provides as value for a customer. So it's a lot more complex let's say than household appliances.

So awareness and knowhow is a major issue. So that is both around irrigation, but also why would I choose solar versus diesel, where are these products available, how reliable are they? Affordability, again, a big issue. As you saw some of those product prices are at the upper end of solar home system pricing currently, so it's a big challenge to finance them, and an element that is around if you are financing them, the credit worthiness of the [inaudible] or whoever is pitching them, but also how does their account accommodate the incremental income as you'll see later.

So for example, in India, farmers quote or report that their income is boosted by over 50 percent. And then the third one, the shaping demand is really water access, to get use out of a pump, you need water, and so you need to be in close proximity to surface water or have access to groundwater through [inaudible] holes or wells. Then there's probably a more nuanced piece around the complexity of the prerequisites for targeting customers. Irrigation is just one piece of how—what is required to create value out of burning a pump, by increasing yields, and by increasing the income. For example, needing fertilizers and then good farming practices at the front end, and then towards the back end, having confidence that yes, I can increase my production, but can I actually sell it reliably through a reliable [inaudible] buyer into a coal, et cetera. So really important to consider how that former fits into broader value chain.

But through huge potential impacts on productivity, the income, time saving, and climate. If you just move onto the next slide—so the report goes into some detail around how solar water pumps are different from—a different

stage from household appliances. Around four brackets, policy financing technology and partners. I won't go into those in detail now because I'll move onto the broader productive use area, but we'll come back to these later and you'll see them come up. So if we just flip to the next slide please.

So solar water pumps fit within the broader category which we've called PULSE, and that's Productive Use Leverage Solar Energy. An acronym just to make it an easier thing to say to some extent. So if we just flip to the next slide, this comes out of a piece of work we completed towards the end of 2018, focusing on productive use of energy, solar energy, in Sub-Saharan Africa, and within it, focuses in agriculture. Their piece of work includes some just underlying trends of where the industry is at. We looked at use cases in different countries to explore the practicalities of how these products actually land in the market. So market sizing, and then we spoke to a lot of actors both in through interviews and through survey just to understand their viewpoints.

And then to that point, I think it's interesting to note that as Mike mentioned in 2013, there was kind of a few actors selling household appliances that has then grown over the course of the last five years. I think that's probably true of PULSE, but we're probably at that 2013 level. There's a small number of players concentrated in brand manufactured products. If we move onto the next slide. So just some quick highlights, and I won't go through these in detail, but we did see an increasing number of products available, more specialist providers on the market. There is a significant variation in maturity of technologies and application in different markets. Solar water pumps is definitely the most mature at different scales with cooling and refrigeration next, and then aqua-processing is definitely an emerging technology group.

The potential is huge, but there is a very big hacker on the potential market by affordability constraint, which I mentioned. But by 2030, rising incomes and other factors like lowering product costs will start to grow that. The next piece here is around how really the business case is not clear cut. There's a lot of complex issues around how much money the farmers stand to gain from adding products. What are they currently using? How much utilization can they get out of the product depending on their proximity and linkage into the downstream supply chain of their agricultural products?

So aggregation is very important, and then there's a wide set of supporting needs that different actors can contribute to, and we'll get onto that next, so if you move onto the next slide, please. So just real quickly, we'll run through the PULSE landscape, some of the products and suppliers, use cases, and then kind of a what next to kind of lead into our panel discussion coming up, too, if you just click onto the next cycle. So how are we defining PULSE, Productive Use Leveraging Solar Energy? So really it is really the difference will be the direct input into the production of goods and services. So whereas Mike was mentioning how refrigerators can be used for income generating activities, this is really where its primary use and its maybe some of its product design is towards that productivity in these different sectors. Flip to the next slide please.

So we started by just appraising the different technologies into different groups and looking at what's out there. It became quickly apparent that agricultural PULSE products are very much more cohesive and concentrated than any others, and was a logical place for us to focus on. Flip to the next slide. So agriculture is obviously a very dominant sector in rural economy, so off-grid economies is high on government agendas given that the amount of population exposed to the sector, and then has some very unique sets for income generation and impact mechanisms. And importantly, farmers are seen as a key growth segment to existing off-grid suppliers in terms of customer base.

Just click to the next slide. Thank you. And the next one. So we started to look at how products would group around their power capacity and their processing capacity, and then whether or not they were focused on single value chains or multiple value chains. Next slide. And we started to focus in on irrigation pumps, cooling and drying, and agro-processing. It's worth noting at this point that we focused on small scale applications, which could be powered by systems of a kilowatt or less, so we kind of called these micro-PULSE solutions. The threshold is kind of a bit arbitrary, but it's really around kind of what—it's that the size of the existing kind of off-grid household solar space, and then it's also kind of in Lighting Global's traditional field of inquiry. And so it's kind of a natural place for us to move off of the existing appliance supply chains.

So if you just click onto the next slide, we're starting to explore how at different scales, the technologies show very different maturities in. So for solar water pumps, they're really the only technology where a different scales and smaller scales, there is a clear evidence of uptake and demand for those types of products. Cooling, there is some demand, but it's usually a slightly higher size, and then agro-processing is relatively solar powered—agro-processing is relatively immature across the board. Just flip to the next slide.

So to support some of our analysis, we engaged with a number of firms from different sets of firms. Solar home system organizations, some early stage pulse innovators, and then some more larger international manufacturers, and if you click back onto the next slide. They come from a range of different sizes, but most are operating at scales where they've sold less than 10,000 products total. We surveyed across Sub-Saharan Africa and some other geographies as well, but there was definitely a concentration around East Africa and significantly a lot of these firms operating in those markets. If you just flip onto the next slide please. So we did some analysis around where people currently are and where they're hoping to go, and whether or not PULSE is a core business.

So it has to be expected solar water pumps is up there, followed by entertainment and agro-processing, but there's a kind of plan and intention to move more into agro-processing and into communications [inaudible]. If you click onto the next slide—

And again, we saw in responses the reiteration of those maturity levels. In fact, really only solar water pumps, [inaudible] irrigation and cooling have

some actors start to feel like this leading innovation, advanced innovation. Or maturity. If you talk agro-processing, I think the level of maturity is certainly basis of emergent. Yeah, flipping on, thank you. So the business cases, we really wanted to understand how these products could be practically applied, and so we developed business cases testing their use in different value chains. So we used examples from Kenya, Zimbabwe, and Cote D'Ivoire. Different value chains with different products.

So looking at different countries allowed us to look at the different kind of structures of the agriculture sectors, and then doing different maturities of the existing off-grid solar markets. Different value chains allowed us to explore exactly how these products can fit into what are quite the diverse agricultural subset. And then we looked at how these products performed, how viable they were against incumbents. Their potential return on investment for a given owner of an asset, and then typical payback periods to look at the incentives to invest with.

So it's worth noting that really, there's a bit of a mixed result here. It's not clear cut. The different levels of incumbency for different products, so sometimes you're fighting against a diesel incumbent. Sometimes you're actually creating a processing step at a level where it doesn't currently exist within a value chain. But some products, like solar water pumps, can show good payback versus a diesel pump within a year. High returns from farmers given the extra yield, and payback periods which if you can finance a product, you should be able to incrementally increase incomes enough to enforce that—reinforces that payback. Flipping on interest of time, I can't go into detail on any one of these at this stage, but just to give a quick note that these are all fully detailed in the report, and the kind of process we followed, methodology was to look at the value chains, look at where there is latency or energy needs within that value chain, look at some of the dynamics of volumes, who is actually currently in that stage in the value chain, look at the performance versus diesel, and then test some of the viability against different utilization parameters. And then look at some levers of how that use case could be improved.

So if you just move to the next level. That gave us a good sense of what some of the challenges are, the constraints that are facing PULSE and scale up for PULSE in market. And it became evident that there was very much energy oriented—so energy access oriented kind of constraints, and then agricultural oriented types of constraints. And then counter to that is the experience and expertise needed to solve those problems. In the interest of time, I think I'll skip on from that if possible. So yeah, so if you pause on this one, I think the—again, suppliers and practitioners in these supply chains echoed that the availability of consumer finance is very important. Maybe again linked to product affordability, and then there's possibly some action steps around customer awareness and just basic knowledge gaps around technologies.

And then if you skip to the next slide. And then the next one. Sorry. Just to summarize as we move into a panel discussion, there's potential support around integrating productive use products better into national policies, both in energy policy, but importantly also in agricultural policy. There's a lot of

room for forming partnerships along value chains, so working with aggregators of agricultural projects, co-ops, for example, rural financiers, some of which Mike mentioned earlier, and then potentially looking at that area of where PULSE can be added into suppliers that don't have it as their core at the moment. So working with adjacent product [inaudible].

Given the early stage and the lack of maturity of some products in market, there's certainly a need for more R&D investment in more efficient DC appliances, but also product design that can help to tailor in products to their specific use case. And then there is also obviously room for some financing at two levels. One in consumer finance to open up affordability and de-risking some of that lending, but also a business level to help some of these organizations that may have already piloted to scale. And one note there is that there are obviously a lot of potential development impacts associated with these products given their income generation as it links back to those SDGs. But also a carbon benefit versus diesel incumbents where they exist. Then finally, I think there is all of this can be underpinned by a theme of the need for collaboration joint ventures and knowledge sharing between kind of traditional energy access organization players and programs and agricultural sector plays during these programs and aggregates.

So I think that's it. And I think we're not taking questions now, but we'll be moving onto the panel discussion, and then we can pick up any questions within that.

Kamyria Coney

Yes, correct, and so we're not going to take any questions now, but please everybody continue to submit your questions. If we don't get to them today, we will individually send out the answers to your really awesome questions that you've been sending in so far. So thank you so much to Dalberg to your outstanding presentations, and at this time, we're going to have CLASP to moderate an expert panelist on connecting the findings of the state of the off-grid market and PULSE report that you guys just went over. And at this time, I'm going to quickly go over some brief introductions for our panelists. So first up, we have Jenny. Jenny is a senior manager for CLASP and has more than eight years of experience in reach, policy development, and implementation of appliance energy efficiency and market transformation projects around the world.

Next, we have Silvia—excuse me, I'm going to say her name wrong. Silvia Francioso, she also is working as a—she's not separate. She's a database specialist at GOGLA. She is—has several data collection initiatives, including Global Off-Grid [inaudible] market report, and prior to that, she has been working as a scouting coordinator for the Devergy East Africa leading the team gathering data and assessing the electrification potential rural off-grid villages in Tanzania through both desk research and field trips.

Next, we have Dr. Rebekah Shirley. She's the chief research officer for Power for All. She is also named Africa Utility Week's 2018 Outstanding Young Leader in Energy, and she works towards better access to high quality energy data and insights for the sector. Next we have Naomi Bruck. She's the project coordinator at the International Finance Corporation. She's been—she

has over 20 years of experience, business development, and project management, and she also speaks over five languages, which is pretty awesome. And next, we have Lindsay Caldwell Umalla. She's the Energy Access Consultant at World Bank Group. She has ten years of hands on experience in the private and public sector with a focus on agriculture, energy, and access to finance.

And at this time, I'm going to welcome everybody to the webinar, and we're going to go ahead and start asking them some awesome questions. All right, Jenny, are you ready to go?

Jenny Corry Smith Thanks Kamyria, and thanks to the presenters and our panelists. We're very excited about this panel that we've brought together, and as stated in the title of the webinar, we wanted to present some of these macro level findings, but then use this panel as all the great work that they're doing through our partnerships with these organizations to connect the dots, not just looking at market potentials and what's the state of the market, but how that really plays out on the ground, both in the data collection and the work that we're doing in collaboration with our partners on the distributed renewable data network, and through other work. So first question I wanted to ask is actually to go to Silvia because a lot of the data that we used in particularly the state of the [inaudible] appliance market report came from the GOGAL sales data collection that's done on a semi-annual basis, and you know, we're looking at a lot more [inaudible] of technologies and appliances as solar water pumps, obviously, also refrigerators, and the ag processing and large scale [inaudible] that was talked about in the PULSE report.

And just would like to get your thoughts on any of the challenges or opportunities you see in collecting this data on these nascent and emerging technologies and maybe how that differs from collecting data on lighting systems that you've done in the past.

Silvia Francioso Hi, Jenny. I hope you can hear me fine. Thank you for the question, and thank you for inviting GOGLA to speak on this panel. Yes, we were happy to see the data featured in this report, and we are very happy that even if it's as presented very like a nascent data collection, we did the first round, and now we're about to finalize the second one, which will be released at the end of October. We have learned a lot, and you Jenny were part of the process. So you share some of the learning for sure, but for me, the most difficult thing was really like to identify the right way of speaking with the company, because we do collect the data directly from them. So there needs to be a strong incentive for them to participate.

Some of the players in the appliances segment especially for solar water pumps and refrigeration units are not the traditional players that we have seen in our off-grid solar lighting data collection, so they are a bit less acquainted with GOGLA and with Efficiency for Access Coalition, and they are not used to share their sensitive data. So we did a lot of convincing work to get them to participate and that's ongoing. So already in the second round with a tremendous amount of new companies joining, especially in the fan segment and in the refrigeration unit segment. So I think it's going to be a lot of

convincing there to be done, but also to showcase with all of these reports, that's really—what marketing tells us that can drive the sector forward, and the companies can use for their own fundraising and we can use to drive sector support. So I think the main challenge is what really like the convincing on the company side.

Jenny Corry Smith Thank you, Silvia. I just wonder if anybody else on the panel has any perspectives on this. I know particularly the light and global team, you're moving looking at more of the productive use products, and also Power for All I know has done some work. Expanding looking at cooking, appliances, and others. There are—I mean you know, opportunities or issues in the data collection and what you see [inaudible] for the sectors to move things forward, and how we can do that in partnership I guess.

Rebekah Shirley Jenny, Rebekah here speaking. Hi, good morning/afternoon everyone. I think the data question is a whole other webinar in itself. There's so many challenges we have with answering these kinds of questions. As the previous panelists are seeing part of the challenge is the nascency of these markets, so ensuring that we are collecting statistically relevant data can be a challenge if we're not both addressing companies as well as consumers themselves, which becomes a challenge of resource and time and many other different limitations. So that's one, and then I would say that alongside that, once you do do a survey to companies to understand whether it's you know, jobs or any other sort of social impact, being able to map that to macro-economic data in a lot of these emerging markets, the really thing about the scale up potential can be very difficult because you don't really have very good input/output data and so on. So I think that there's a challenge around sort of the meta data that is available.

And then there's a challenge around needing more organizations like those represented in this panel to be doing this kind of research and validating each other's studies.

Naomi Bruck Yeah, hi, this is Naomi Bruck from Lighting Global IFC. I couldn't agree more. I think the other three aspects I would add is that we—if you are a company that's trying to enter a market, that market information is extremely valuable, but that market information is only as good as the input that we get from companies that are collaborating and willing to share that data, but there is the tension of course because these companies would like to guard their data and keep things like sales data or growth data relatively close to their chest. And I think in the interest of sort of increasing market information, it would be fantastic if we could continue collaborative programs that we have with GOGLA, for example, where on a six monthly basis we are collecting data from over 142 companies to try and inform what's happening in the market, but also what the trends are, what the growth prospects are, but what's needed from the development finance community.

I think what is super super exciting and what is on poised on the market front is remote data that will be gathered hopefully within the decades to come where data gathering will become a bit more easier and cheaper and more accurate, and so I think this will become a very, very interesting field for us.

Jenny Corry Smith Thanks, Naomi. So I want to switch gears a little bit and talk a little bit. So we talked a lot about the market potential and looking at sales and growth, but then there's also if we move upstream looking at what's happening along the supply chain and the value add, and also the jobs that are being created. As these appliances are coming to market, both along with the supply chain and also through the distribution network in addition to the jobs that are being created for actually using the appliances, you know, that the farmers who are using the solar water pumps to add value or expand land. So I know this is something that Power for All recently put out a report on, and you know, looking at some of these numbers that [inaudible] presented on the total addressable market, and for example, solar water pumps, that is projected to be 15.6 billion, which is a large market. I just like to hear based on the work that you've done in Africa and South Asia how this might impact deployment opportunities and workforce training.

Rebekah Shirley Sure, thanks for that question, Jenny. I think that one thing that is really clear from the Dalberg presentation is that the future of work is really a major challenge for Sub-Saharan Africa. Agriculture is one of the largest employers as we all know, and is really majorly affected by climate change. Right now, I'm hearing Kenya and this year the rains were really below average. I'm sure many of the listeners on the webinar are also seated here in Kenya and saw how unpredictable those rains were and how low they were. So that presents a major challenge alongside [inaudible] and other things. And at the same time as agriculture jobs become more scarce, we're experiencing this youth explosion across the entire continent where now more than 35 percent of the population is just between the brackets at 15 to 24 years old. So that means that jobs and especially rural employment is a major policy priority. It's a major policy priority for local government, but also for major institutions like the AFDB, that established its job space in [inaudible].

So I think the jobs thing is one thing, and then at the same time, another major policy priority is power, and I think that what we're seeing now is especially because so many of those are electrified, are rural, there is a large push towards rural electrification strategies right now, which is great because rural communities are really best poised to benefit from energy access. Unlocking all the kind of productivity that the Dalberg team was talking about before from irrigation to milling to grinding, drying, cooling, processing. So these are nascent sectors as we saw from those graphs, but they're really I think well poised, especially with access to energy as a driver, unlock economic growth and to unlock jobs creation. So really these two pillars are intrinsically connected, energy and jobs.

So we did a study this year to explore and really understand what exactly is that relationship between energy access and jobs, and what are the kinds of jobs being created and what are the skills gaps. Let me just tell you one or two things that we found to answer your question directly, Jenny. We found that when surveying the area, companies or [inaudible] companies or distributed renewable energy companies directly, we found that there are a significant number of jobs being created, as many as in some of the local utility sectors. For solar water pumps specifically, we found that the companies that are distributing both the submersible and the surface water

pumps are employing on the order of a few thousand in India and a few hundred in Kenya for instance. But really where the kicker is is in the productive use that's stimulated by access to energy, technologies. What we found from companies was that anecdotally, there is so much happening in the—as I mentioned, the giant incubation, even honey processing, we heard of melon grinding. So there's really a lot happening in the space. One of the challenges is that these companies often don't do very rigorous data collection. Of course, they're very time and resource strapped and they need a lot of support in that area. So that's one major takeaway.

But that said, we were able to draw estimates from the future and find that productive use jobs are on the order of over 60,000 in Kenya and over 15,000 right now in Nigeria. So there's really a lot of potential here, even in the nascency of the sector for jobs creation. The last thing I'll say is that another thing that we found is that there's a lot of—creating the jobs is one thing, but filling the jobs is another, and so skills gaps were a major challenge identified by companies both in terms of their wanting to hire persons directly, but also in terms of helping to stimulate rural entrepreneurship or agro-preneurs as a phrase that we heard used. There's really a lot of support that's needed to—and similar ways to support rural business.

So there's a real investment opportunity there, and not just for thinking about the companies and technologies themselves, but investment in initiatives to support skills training. So we are planning to expand the scope of our study. This was the first time we did it, and we are expanding the scope next year to include more countries, and to also do a deeper dive into productive use. So if there's any organization who is listening that would be keen to support that effort or be involved, please let us know. As we just mentioned, you know, the more organizations that get involved in coordinated efforts around research, the better.

Jenny Corry Smith Thanks, Rebekah. And thanks for sharing those numbers. They're very compelling, and I'm just thinking about the various pieces all of our organizations have, and one of the huge gaps that was identified in both of the reports is policy, and a real enabling environment to facilitate market growth of appliances and productive use. And I'm thinking about the actual sales data that GOGLA has collected, the market potential numbers that we now have from Lighting Global and Efficiency for Access, and then this initial jobs report, and how that could be potentially packaged and make a really compelling case for policy makers if they can see those things coming together.

There's the huge market potential, but sales are still relatively low of appliances, and they're also creating jobs. I think if we bring—are able to bring all that work together and really advocate for change with policymakers, we could have a significant impact in maybe helping to drive some of the change. So I think we have time for at least one more question, and I think I want to hear everybody's perspective on this that maybe start with the Lighting Global team because the Lighting Global team has been working for decades to support the solar home system, and off-grid lighting sector. And now you know, as we're beginning to see some significant

growth and uptick in the appliance market and this merging productive use solar market, what lessons do you think we can take from what the Lighting Global program has done in the Pico Solar and solar home system market, and apply it to growing these markets that—and maybe what doesn't apply. What are the challenges? What's very different, but what maybe is the same in the programmatic work and the support that Lighting Global has provided to the sector. And then I would ask similar questions to Power for All and GOGLA as well. So maybe the Lighting Global team can start.

Lindsay Caldwell Hey, Jenny, this is Lindsay. Naomi and I are going to tag team the question, kind of speak to the parallels, and also some of our key lessons learned. I think overall, we see the exercise as very similar. We're essentially engaging in a market building exercise which means just like we had been doing with the lighting market, more targeting support, demand, supply, technology development, quality, the policy environment, and of course finance as well. And I think the parallels are most obvious in terms of demand. There's a huge overlap between who the end consumer is for the productive use users that we're targeting in this report and through recent targeting through the lighting market.

And obviously, some key parallels in terms of supply, but I think obviously this is where different distribution models may be necessary and slightly divergent from the lighting market. And then I think obviously, and this is emphasized already by Dalberg, finance is a key challenge that we have been and still are trying to address in the lighting market, and we'll be critical to the development of the productive use market as well. And that could be similar financing mechanisms for the appliance companies and for the consumer and also leveraging of existing models like pay as you go or partnerships with MNFIs or even creative and different solutions for PULSE as well.

And maybe just to highlight a few points, I think that Dalberg also hit very well which I think resonate for us here at Lighting Global is just thinking of the question of the who, and who is best positioned to deliver on productive use technology. We're already seeing many of the solar companies move into this space, but I think with the clear recognition that this is a completely new sector for them, and they are learning agriculture. So there's also great potential for us to see a number of new different companies also entering this kind of nexus between energy and agriculture, and maybe just one kind of second point I think is just the kind of emphasis and criticalness about behavior change and after sales care that diverges maybe slightly from what we see in the off-grid market where with fuel stacking or with a [inaudible] to kerosene when a technology doesn't work, delivering on after sales care where productive use technology is an absolute imperative as is the education of the consumer.

But then turning over to Naomi. No, it's a little difficult to hear you, actually, Naomi.

Naomi Bruck Sorry, is this any better? So I think I'll pop to your question on what lessons we can learn from over a decade of having worked in this field. I think we see

in terms of game changers for the off-grid market that we've learned over time that there are a couple of branches that are really important in terms of developing the private sector environment, and these are factors that disproportionately help companies succeed in the market compared to other factors. And the factors have been—I mean these are repeated themes that we've heard throughout all three of the presentations, and so these should really be familiar to you. But as far as we're concerned, absolutely around financing and affordability.

So working capital, debt financing. Local debt financing is absolutely critical we feel. Given really uncertain [inaudible] environment. And then around consumer affordability, so again, this has been covered significantly during the presentations that Dalberg did. Other factors are mobile money penetration, government endorsement for [inaudible]. So you know, governments welcoming, understanding, and encouraging both the companies as well as the products that they're bringing. And then the other factor that we thought was really important that we've learned from hard graphs is really the correct pricing of the product in the interim markets, and just to give a nuanced example, and I'm appreciative of time so I will keep it brief. Two other things.

So one lesson that we learned in Lighting Global is in relation to behavior change. It takes time and it's really important that the appliances work and that the customers know how to work it. Otherwise, you're facing the risk of market contamination, which is one of the reasons why we focus so much on quality in Lighting Global, and once you have a contaminated market, it becomes such a hard battle to fight and encourage companies to sell and consumers to believe. I think just a really important plug is to say over the last ten years, this market has matured considerably. These products are now legitimate solutions to address energy access, governments, and development institutions are kind of increasingly accepting of them. They accept private sector led decentralized solutions. I remember a time ten years ago when these were considered slightly gimmicky, and that's absolutely no longer the case, and that's fantastic.

Lindsay Caldwell I think the only thing I might add, Jenny, is just to also highlight on behalf of the Lighting Global the work that we're doing to support in addition to the study that's already been introduced, but also working at a country level sort of financing [inaudible] market level of research to also contribute to governments' understanding of this sector and the potential and hopefully as well the private sector.

Jenny Corry Smith I'm conscious of time. I was just going to ask Silvia maybe if she just wanted to speak for two minutes from a GOGLA perspective as they see more of their numbers, start to sell appliances and moving into the space.

Silvia Francioso Yeah, thanks for the question. I think there's a lot of lessons learned, and as Naomi and Lindsay—I think they captured it very well from a financing perspective. I think from our perspective, seeing the companies that have learned so much and through the productive use space with all their experience I think will help them. They will need to definitely understand that

that's a different space, and they need to still learn a lot about it before they can actually meet all the demands that are there. From our perspective is really we can learn from all we have done in our regional representation and talking with governments and really to go down to the level to make them understand as much as possible, and make sure that the company's voice is heard in the most neutral way as possible, but still quite strong enough. So I think that a lot of productive use companies are starting to join our membership base, and we see how different or similar they are and how similar challenges we can address with the experience we had on the lighting side to get with all the partners. I think the challenge is really going to be on a single country level as these products, they don't look dramatically different than the AC grid ones, so I think it's going to be a different conversation showing them how much better they are technically without going into too much technical conversations.

Jenny Corry Smith Thank you. And again, conscious we're short of time, Rebekah, sorry. I don't know if you want to just take 30 seconds and say any key lesson maybe you've learned for Power for All.

Rebekah Shirley Sure. I will just say that I think of course there's stronger collaboration that's needed on developing industry relevant curricula and so on for supporting jobs creation and soft skills training, but I also really think it's important to know that these energy conversations are often lumped into infrastructure conversations as far as policy goes, and so it's really important for us to help to create advocates across education, health, food security, rural development to lobby for better data, to lobby for more support for these kinds of organizations and companies as well.

Jenny Corry Smith Totally agree. Thank you so much, Rebekah, and sorry we didn't get a chance to address the audience questions. But as Kamyria said, we can e-mail those out, and I'll hand it back to you, Kamyria to close up.

Kamyria Coney Yes, thank you guys so much for the expert panelists. We really appreciate it, and just like Jenny said, we won't be able to get to the audience questions today, but I really appreciate your guys' questions. Please keep them coming. We're going to send them all to the panelists and to our presenters today, and they will get back to your questions individually as soon as possible. So with that, 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 very much appreciate your time and hope in return that there were some valuable insights that you can take back to your ministry's departments or organizations.

We also invite you to inform your colleagues in those newer networks about the Solutions Center resources and services including no-cost policies support through our ask an expert service. I invite you to check the Solutions Center website if you would like to view the slides and listen to the recording of today's presentation as well as previously held webinars. Additionally, you'll find information on upcoming webinars and other training events. We're also posting our webinar recordings on the Clean Energy Solutions Center

YouTube channel, but please allow about a week for the audio recording to be posted.

Finally, I would like to kindly ask you to take a moment to complete the short survey that will appear when we conclude this webinar. Please enjoy the rest of your day, and we hope to see you again at future Clean Energy Solutions Center events, and this concludes our webinar.