

Promoting Clean Mini-Grid Public-Private Partnerships for Rural Electrification in Nigeria

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Webinar Panelists

Jem Porcaro	United Nations Foundation
Jannik Moeller	Nigerian Energy Support Programme
Femi Oye	GoSolar Africa
Ifeanyi Orajaka	GVE Projects Limited Nigeria

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Eric Welcome to today's webinar, which is hosted by the Clean Energy Solutions Center in Partnership with the United Nation Foundation's Energy Access Practitioner Network and the Nigerian Energy Support Program.

Today's webinar is focused on the development of clean energy mini-grids in Nigeria. This webinar forms part of the U.N. Foundation's new country-focused webinar series that will delve into the state of energy access across different parts of the world starting with countries in sub-Saharan Africa.

One important note of mention before we begin our presentations is that the Clean Energy Solutions Center does not endorse or recommend specific products or services. Information provided in this webinar is featured in the Solutions Center'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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If you'd like to ask a question we ask that you use the questions pane where you may type in your question. If you are having difficulty viewing the materials through the webinar portal you will find PDF copies of the presentations at 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 pages in a few weeks and will be added to the [Solutions Center YouTube channel](#) where you will find other informative webinars as well as video interviews with thought leaders on clean energy policy topics.

Today's webinar agenda is centered around the presentations from our guest panelists: Jem Porcaro, Jannik Moller, Femi Oye, and Ifeanyi Orajaka. These panelists have been kind enough to join us to discuss mini grids in Nigeria.

Before our speakers begin their presentations I will provide a short, informative overview of the Clean Energy Solutions Center initiative, then following the presentations we will 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, Sweden 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; it also serves to share policy best practices, data and analysis tools specific to clean energy policies and programs. The Solutions Center delivers dynamic services that enable expert assistance, learning and peer to peer sharing of experiences.

And lastly, the center fosters dialog on emerging policy issues and innovation around the globe. A primary audience is energy policy makers and analysts from government, technical organizations in all countries, but we also strive to engage the private sector, NGOs and civil society.

A marquis 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 from around the globe are available to provide remote policy advice and analysis to all countries at no cost.

For example in the area of renewable energy policy, we were very pleased to have Katherine Dienva serving as one of our experts. If you have a need for policy assistance and renewable energy policy 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 it through our simple online forum at cleanenergysolutions.org/expert. And we'd also invite you to spread the word about this service to those in your networks and organizations.

Now I'd like to provide very brief introductions for today's panelists before we jump in. First up today is Jem Porcaro, who's the senior director of energy access at the U.N. Foundation. Following Jem, we will hear from Jannik Moller, who is the head of the Rural Electrification and Sustainable Energy Access Unit at Nigerian Energy Support Program. Following Jannik, we will hear from Femi Oye, who is chief architect at Go Solar Africa. And our final speaker today is Ifeanyi Orajaka, who is the founder and CEO of GJVE Projects, Ltd Nigeria.

And, with those brief introductions, I'd like to welcome Jem to the webinar.

Jem

Thanks Eric. I appreciate that. I'm going to just pull up my slides here. So again, my name is Jem Porcaro; I'm the senior director of energy access here at the U.N. Foundation. On behalf of the foundation, I just want to welcome everyone online to this webinar on clean energy mini-grids in Nigeria and thank in particular our guest speakers for joining us and participating today in what I'm sure will be a very interesting presentation.

Before I hand it over to Jannik and the rest of our guest speakers I just wanted to kind of set the scene a little bit and provide a little bit more introduction to the energy access practitioner network.

I don't think I need to talk about the challenge or the impetus for the energy access practitioner network. I'm sure everyone here online is well versed and sensitized to that. But for those of you who may not be as familiar with the energy access practitioner network we established the network back in 2011 as part of a contribution to sustainable energy for all.

Over the years, we have grown—at least our membership has grown. We are now upwards of 2,500 members representing a number of countries globally. We really see ourselves as a platform for exchanging information among energy practitioners, working principally in the off-grid sector. And so in doing that we seek to promote innovations in policy, technology, business and financing, try to amplify the voice of the practitioners and high-level decision-making and importantly trying to facilitate increased funding and financing of decentralized energy solutions. And as you can tell we are technology agnostic and represent a wide suite of technologies with a strong emphasis on renewable energy, solar PV, energy efficiency, wind, biofuels.

So that's a little bit about the Energy Access Practitioner Network. As Eric mentioned this webinar is meant to provide an overview of the mini-grids sector in Nigeria, and we'll hopefully hear a couple of case studies. This is the second webinar in a new country-focused webinar series at the U.N. Foundation as recently launched with the generous support of the Mott Foundation.

And for those of you wondering why I start with kind of this topic. Well partly, it's because we have quite a few members in the network who are either headquartered in Nigeria or are working in Nigeria. That's not surprising. We also know from our most recent annual survey, which we concluded this summer, that roughly a little over one-third of individuals who responded to that survey indicated that they were involved in some aspect of mini and micro-grid development in 2015. So we realize that a large share of our membership are actively involved in this sector, or are at least interested in it.

The other reason is in addition to running the Energy Access Practitioner Network the U.N. Foundation also serves as the co-secretariat of the Clean Energy Mini-Grids HIO, again, under the auspices of the Sustainable Energy for All Initiative. And so we wear two hats and are quite involved in that partnership which has obviously some overlap with the Energy Access Practitioner Network.

And I should also mention for those of you who are interested as part of our secretariat functions for the mini-grids HIO which is really a consortium of organizations who are interested in this space and share information periodically we prepare and put out a quarterly clean energy mini-grids newsletter on behalf of the HIO. And if you're interested in receiving more information about that, I've provided some contact details.

The other reason for starting out with this topic is we know that Nigeria is really home to the largest number of people lacking electricity in sub-Saharan Africa. In fact, outside of India it is the largest home in Africa. And so we figured it was a good place to start for a country-focused webinar series.

I'll conclude by kind of basically teeing up a question I think for our guest speakers. I know they will kind of get into the nitty-gritty of their experiences and all of their good work. But I would kind of propose a kind of a very high-level question to all of our guest speakers if they could address it in one way or another. And that is really kind of, what does the future hold for mini-grids in Nigeria. And I ask that in light of some kind of interesting developments happening in Nigeria recently. We know on the positive side that Nigerian Electricity Regulatory Commission has recently revealed some draft regulations for mini-grids which in theory should pave the way for further development and investment in this space. We know the Sustainable Energy for All action agenda makes mention of off-grid systems and mini-grids and looks like they're relying on mini-grids to supply a significant, or at least a somewhat significant portion of the energy supply, or addressing the energy access challenges in Nigeria in the years to come.

But we also know from some recent modeling that the projections show that mini-grids could play as little as 2 percent—or I should say could provide as much or as little as two percent of supply in the efforts to achieve universal energy access and perhaps up to about 14-15 percent, looking at it from a cost-effective point of view. And so with all of that in mind I kind of would tee up a question to our guest speakers and really ask them to shed a little bit

of light on how they view the market for mini-grids in Nigeria over the next 10-15 years.

And so with that I'm going to hopefully pass it on to Jannik.

Eric

Great. Thank you for that introduction, Jem. Jannik, it looks like you may be on mute, perhaps?

Jannik

Yeah, now? Right, and my screen should be there as well. Yes. Full screen is coming up. Thank you very much.

Thank you, and hello everybody. And I'm happy to be part of this mini-grid, as we all are. This is a little bit on supporting the development of a privately led mini-grid market in Nigeria.

First of all a small introduction to the Nigerian Energy Support Program. It is a technical cooperation program and it's aiming at enabling a framework for renewable energy, energy efficiency and rural electrification. And of course, we have a focus on renewable energy for our mini-grids.

It's funded by the European Union and Germany and the funding is €24.5 million, which is €15.5 million from the EU and €9 million from the German government. It's implemented by GSS and the federal partners in Nigeria who are the minister of power works and housing. We also cooperate with the Rural Electrification Agency and the Nigerian Electricity Regulator Commission, NERC. Then we are active in five partner states: Niger State, Ogun State, Cross River State, Plateau and Sokoto.

Well, the structure of Nigeria as a federal nation with different ministries and agencies on state and federal level actually overlap each other, especially on the rural electrification. And there is no really transparent procedures in place. And this actually creates, I would say, a very difficult environment for the private investors to engage in rural electrification. Thus, it's important to prepare good understanding and political commitment from authorities regarding mini-grids and private participation in this.

The foundation is in place, the National Renewable Energy and Energy Efficiency Plan has been approved, and the same also with the legislation for the electricity power sector reform acts, which actually outline the way forward for private involvement in the electricity sector. So the legislations for the mini-grids, they are there.

NESP has commented on the recently approved Rural Electrification Strategy and Implementation Plan, and we also support a rural electrification agency in developing transparent guidelines for how to access the Rural Electrification Funds. The Rural Electrification Fund has not been operationalized yet, but the aim of the Rural Electrification Fund is a grant for operators doing mini-grids and also technical assistance.

The Rural Electrification Fund is supposed to provide grants in the bank as opposed to issue concessionary loans as a vehicle for the Central Bank of

Nigeria and other entities. We try hard to develop these support mechanisms, and one example could be that you get grants from the IEF, from the Rural Electrification Fund and the operator uses these grants to get a concessionary loan from a bank. He bought the equipment and then used that as a [audio glitch] collateral for a loan.

The PPP framework sets up guidelines for how the government can support the private sector with subsidies, permits, use of land and regulatory approvals and things like that. The light-handed regulation is to protect the private investors. For example, when the big grid meets the small grids. And it should also protect the investor from political interference in tariff setting.

One issue in doing mini-grids is always on what is an attractive investment and what is an affordable tariff. And the regulations, so to say, helps out putting all parties on the same page.

[Audio glitch] We have done quite a lot of GIS mapping in Nigeria. And the GIS mapping on rural electrification actually show a great potential for mini-grids in Nigeria. The clusters, as we call them, which could be cities, towns, communities, etc. they got a good size and further they also got a lot of economic activity. Further, do to badly maintained medium _____ lines and insufficient generation capacity there are also good possibilities to do what we call interconnected mini-grids. And that is areas with a grid but no supply. There an operator can come in with a generation source and connect it to the grid and use the grid to supply his customers. Of course before doing this you also need to talk to the distribution company because after the privatization the grid is owned by the distribution company.

Federal entities, state and distribution companies they are all working together on data collection for electrification planning and modeling. And this is very good in the electrification planning exercises that we're doing. [Audio glitch] all people are buying in on this.

Data, they are compiled into a GIS-based electrification plan. And these data they will in the future be a vital source of market intelligence to the private sector and a tremendous tool for the public sector in their task supplying the right support mechanism. That means that they can do improved policymaking based on facts.

Here you can see some results of the modeling that we have done in Nigeria. We have set up a number of criteria and we have assessed a lot of different available data. And out of these data, we can see that for great electrification we have identified 34,500 clusters and 57 million people who should be electrified by grid extension. That means that these people, they live very close to the grids.

The next line, the mini-grid electrification that is mainly clusters which have a size above 2,000 people and also they are more than 10 kilometers away from existing grids. Further, there should also be productive use of energy or possibility of developing productive use of energy. Here we have almost

4,000 clusters, and there's 12.8 million people. And these people they could be electrified by mini-grids.

For solar home systems, we have identified a little bit more than 7,000 clusters and there's 2.8 million people. For these clusters for solo home systems this is also clusters which are far away from the grids, and the clusters they are smaller than the mini-grids electrification clusters. That's also why that you have almost doubled as many clusters but only almost three million people, instead of the 12.8 million people for mini-grid electrification.

On the graphics, it's interesting to see if you can find the most urban areas like Federal Capital territory, which is one-third from the left, and Lagos, a little bit further to the right. You will see—and not surprisingly, there are actually very, very few, or I would say no possibility of doing mini-grids. However, you can still do rural electrification.

If you go to the northeastern part of Nigeria like Borno you will see that grid electrification, that will be around a million people, and mini-grids could be two million people. And that indicates that the grid infrastructure there is very, very poor, and there are a lot of communities around in Borno who have no other possibilities than being electrified by mini-grids. So Borno is definitely a mini-grid area. And this is also because it was announced that we should think a little bit about the market potential. So I would definitely say that there's a market potential on Borno. However, the security situation might not be so good in that area. Another good area could be Plateau State, and there they also have around a million people could be electrified by mini-grids.

The yellow bars that you can see indicate solar home system, and they are also for Borno; indicates that it's definitely an area that if you want to sell solar home systems then you should go to Borno. Plateau State, Taraba, Yobe would also be interesting areas for vendors of solar home systems.

Of course all of these data we are using them obviously to do electrification plans. And this is a result of the planning of Niger State. You can see the grid, and the grid covers which are marked by red. And this also indicates the different communities which should be connected to the grid with grid extension. And I also have to say that this planning actually consider that the grid is up in a working condition, that the grid is functioning, which it is not, unfortunately.

You can see all the clusters that we have marked by yellow; that is standalone systems. So that means that these are areas which should be electrified by solar home systems, and the mini-grids areas they are green. And these maps they are, of course, a vital source for the private sector to engage in Niger State because here they can see and they can in their planning data they will also be able to find the coordinates. So they can drive directly to the village and see how is the situation on the ground and develop a project in this area.

We are supporting local and private mini-grid developments and in 2015, we launched a guided idea competition. It was a competitive process which

resulted in the selection of five mini-grids developers, operators. And this is GoSolar, Nayo Tropical Technology, Rubitec Nigeria and Community Research and Development Centre and GVE Projects. And you will very shortly hear some of them speaking here on the webinar. And the five winners from this guided idea competition they benefit from our technical and final assistance from the NESP to develop solar mini-grids pilot projects.

A little bit about our support to the private mini-grid developers. We support them in preparing bankable business plan, and this has been including a site identification, demand assessment, system design and financial modeling. We also facilitate contact with the federal and the state governments in order to ease the process of acquisition of regulatory approvals and also to get the building permits, the right of use of land, etc.

Then we facilitate contacts with investors and financials to access debt and equity to cover for part of the capital cost of the mini-grid project. We will later also most likely see if we can do matchmaking events between investors and operators.

Provision of grants channeled through the state partners to cover for remaining capital costs for the mini-grid projects. And finally, we also prepare a replication strategy which allows the developers for a fast expansion. I think this is very important that the operators can develop new projects as fast as possible because the more projects they can have up running the better businesses will be for them and it will be easier to reach a critical level of customers in mini-grids.

We also support mini-grid investors. We have trained bank mini-grid finances on what a mini-grid actually is and how they function. We also want to pilot crowd-funding for mini-grids in Nigeria in a public-private partnership with a company called Bettervest. And under our public-private partnership with Bettervest NESP they will provide legal advice and technical and financial advice on mini-grid development. And Bettervest commits to finance at least one pilot project during the first round. And if it's successful then they will continue with additional projects.

This idea with crowd funding for mini-grid I think is quite exciting because then anyone in the entire world can actually help financing mini-grids anywhere that you can do a mini-grid, actually, in the entire world.

I think this was it and then I will say thank you and good bye for now.

Eric

Thank you very much. We'll switch over to Femi now.

Femi

Thank you everyone, and I'm happy to be joining you today. Jannik already has given a lot of background to our project that we have. My name is Femi Oye. I represent GoSolar Africa. So GoSolar Africa is a new mini-grid company based out of Nigeria. We were established in 2007 and we started our first mini-grid project in 2010. Prior to that, we also involved low-cost LED solar lanterns and pico solar systems. So we distributed over 200,000 of

that to-date and we have some 18,000 solar home systems as well that we've done.

And with seven of us because two million customers as of today, and then you have for my slide here a total install capacity in terms of every unique work that we're having to our solar aggregation. That one is represented on our website, OneWorldSolar.org.

I would quickly talk about our recent mini-grid project that situate heading Sokoto State from the red slide that you have here. Sokoto is situated in the northern region Nigeria. Unlike what Jannik said about the risk of getting into Borno State, we are operating out of that region which is Sokoto. Sokoto is quite safe and there are lot of economic activities coming up in those regions. However, they must still resolve some challenges in getting more people connected to the grid.

The Kurdula Electricity Distribution Company is the one that supports Sokoto as a sub-region, but unfortunately, we have a huge number of communities, like we have identified on that the NSB-supported project for the mini-grid program in Sokoto State, about six identified villages and communities, total to about 20,000 inhabitants. And out of those six, I will just be talking about the most viable one that we are starting up with. We intend to install about a 90 kilowatt mini-grid system for the Kurdula village out of the six that we have. Kurdula has about—based on the studies that have been done, already completed with the support given by GEZ and SP program we have about 6,000 people living in the community, and we have identified about 800 houses that are ready to actually connect to our mini-grid. And we are talking about communities that do not have any existing grid connection into this.

And one very important point is for the expansion for electricity for the future is very important for both government and businesses to begin to look at how we can make this modular. So it costs ten times what it's going to cost for a mini-grid both from start to finish as against grid extension. So mini-grid is perfect for a community like Kurdula. And of course, the solar radiation it's quite good for the entire six communities that we have.

The business model that we have would integrate prepaid pay-as-you-go technology as well in order to help reduce the risk and also to de-bottleneck the challenges with our revenue collection.

And for the summary of what we intend to do there I already talked about that we have about six to 10,000 beneficiaries for the community, and we have divided that into customers that are in houses. We also have mature customers. And of course we have residential customers, those ones that what they use on daily basis do not really go beyond 100 to 200 kilowatt—I mean what are indeed.

And one of those indicators are reason for GoSolar Africa to assess or to consider any mini-grid project in any community. We want to guarantee that we have at least 20 percent of the active users in those communities to be involved in a commercial—one sort of commercial activity of productive use,

in which Kurdula village actually qualifies for that. And we have the eye and the peak and the tariff that we have of about 150 naira here. In dollars that would give about _____, which the dollar be having to Nigeria we can put that at 35 to 40 cents per kilowatt hour of electricity.

And the layout from the slide that you have to the right you have the white region there. That is where the mini-grid station is going to be, and then you have the blue lines and the red line that depletes. Those ones have major connections and those ones that are going to be interlinked within streets and house to house. So most of the work here has already been fully designed. The DOQ has been done. And then we also understand how much it's going to cost to connect the entire community. And which all the six other identified mini-grids have been identified in Sokoto State. We also intend to continue to expand this in a modular form from one community to the other. But then the total energy that we are generating here is capped at 90 kilowatt per hour. And we will be using a battery system.

And it is also important to say that this solution that we're providing has been designed as a hybrid, looking at the peak period. So we will be installing a diesel generator set to make up for when you have it peaked, and we're using the sun to actually do the interchanging between the aggregate generation from PV to when the diesel generator is going to come up.

So quickly about the financials and the figures. We have put the entire investment for about 160 million naira for the entire Kurdula installation mini-grid, and we are receiving a good portion of that from the NSV GIZ grant support that originally was to go into the distribution section of that, looking at the fixed assets. We are also considering that to be flipped over as well to taking care of some of the moveable assets as well. So that comes to about 11 percent of the entire funds that we're looking at.

So out of the 160 million 30 percent of that is going to be in equity and we have debt also. And we are talking to SEFA from the African Development Fund as well. They might be also coming up with some unlocking of pension funds that will go into the technical work that has to be done in terms of operation-wise. And we're looking at sources of funds from the OPIC, Acumen Fund, and of course SME Funds will be putting an equity into the same.

In terms of profitability, we have projected this particular project in two ways, looking at a lifetime return of 15 years and of 20 years. So when we put it, depending on which one comes first, if we are able to secure a higher percent of debt before equity comes then we'll be looking at 7 percent in terms of rate of return. And if we are able to get equity quickly into that—so we have extended that to like 20 years and now of course move our ROI to about 19 percent, and then charging about 150 naira per kilowatt hour. So we should be having between 2.5 to 3 million naira revenue from the system every day. And when you spread that into our financials—so we hope to actually break even between 10 and 12 years, or getting into 15 years looking at the lifetime of the project.

And it is very also important to also look at the projected accumulated cash loop that we've done here. So when you look at—between the 9th and the 12th year we're actually looking at how we can pull back some of the retained earnings of what we have to quickly cut back into the payback that we want to achieve for the 15th or the 20th year. But then the cash flow has been estimated to be steady, and looking at other leveraged funds that might also be coming in during the lifetime of this project, if we are eventually able to secure the right kind of finance for the fixed assets side of the project.

That is one of the reasons why mini-grids could be challenging because developers don't just have to invest only in the generation but we are also investing in this typical project into the distribution as well. So if I happen to be just a distribution company then I don't really have to think about generation. But in this case we have to look at this side-by-side and that also forms a kind of bottleneck and challenges that we've identified going on a mini-grid distribution solution in developing or emerging economy. And then finally over the years, since 2010 that we started this work we've been able to get some awards and then recognition as you've seen, and just of recent in August we flagged over forced solar power refrigeration systems, which is a very important aspect of our project as well that would also tie the loan with our mini-grid expansion across Nigeria. This was supported by the USA DF fund, and it's about five systems that we're going to install to support farmers and help to extend the shelf life of fruits and vegetables in some of the remote communities. And we've done close to about nine solar mini-grid systems in different communities in Nigeria; four of that supports productive use in high, dense areas where you have business and small business activities by SMEs. And we have the grid metering system that we use for this project.

So that's about summary of our project for the NSB GIZ mini-grid project in Nigeria. We hope to move to site [audio break 0:45:46 to 0:45:53].

Eric Great. Thank you very much.

Femi [Begins mid-sentence] by 2017 to start the _____ 2017 year for the entire five other mini-grids that we are _____. Thank you.

Eric Thank you for that great background on GoSolar's work.

We'll go over to Ifeanyi now.

Ifeanyi Hi everyone. My name is Ifeanyi Orajaka. I'm the founder of the GVE Projects Ltd. Nigeria and we're very happy to be here to be sharing some of our experiences, particularly LESB _____ PV solar hybrid mini-grid project in Plateau State.

GVE Projects Ltd was founded in 2009 by three young Nigerian students of Federal University of Technology Ueri in the southern part of Nigeria. While still undergraduate students we pioneered the PV solar mini-grid technology in West Africa. And since then, to date, we have successfully completed six pilot projects, and currently have a pipeline of about 72, and part of which is the two we will be talking about today. And since then to-date we have

reached slightly of two million USD, which we've committed to the mini-grid in combination of both grants, equity and also concessional debt.

Our mini-grid model has been rated by UC and GIZ as the ideal model for advancing energy assets in Nigeria, as there is a lot of the successes of our completed pilot projects. The company was rated by _____ Solutions as one of the top 60 most promising sub-Saharan SMEs last year. And because of our _____ narrative role in pioneering the mini-grid technology in West Africa, we are granted the Nigerian government pioneer status _____ which is still ongoing. And I can say with some of the award we've been able to attract so far truly integrated technology which includes the primary project of the year, an African Energy Awards in _____ South Africa earlier this year, and finally the South African Firm for Clean Energy Business _____ competition last year.

Part of also the GE USAID fund, Power Africa, Beyond the Grid Energy Assets Challenge, which we were one of the pioneer winners. And below are some of the corporate partners we have been working with in developing our mini-grid technologies and they include Bank of Industry Nigeria, GIZ, USAID, Power Africa, IEEE Smart Village, Deloitte, Schneider Electric and all of the others.

Specifically today, we'll be talking about the mini-grid projects we are developing in Plateau State. Plateau State is in the northeastern part of Nigeria. So you can see from the blue bubble here, and also from the slide Jannik shared earlier _____ generally consider Plateau as one of the states with the highest mini-grid potential in the country.

Specifically we are looking at two communities of about 2-1/2 kilometers apart and they are by name Angwan Rina and Demshin which are in _____ part of Plateau States. The GPS coordinates of both communities are projected on the screen. The communities have a combined population of about 4,800 inhabitants, split into roughly about 536 households. And there's a very big market servicing many villages in the vicinity. The communities are very productive with a lot of commercial activities ongoing, and they are already authority _____ centers in the region where we are located. And that's a both fairly _____ potential when electricity is introduced in these communities for the _____ potential and further expand the potential of the community for being a regional hub.

And going down to the numbers, the number of indirect beneficiaries for a project is about 4,800 and number of direct beneficiaries 3,216. Number of households _____ roughly about 500 and number of commercial customers 122. From our experiences in deploying mini-grid at the moment six mini-grids we have all across four different states in four different regions of Nigeria. And from the experience joined from these pilot projects, we've come to realize that it makes more economic and sustainable impact to have a mix of at least a minimum of 35 to 65 percent commercial to household population.

And also in the communities we have a community of four community customers _____ productive users including a telecom tower by one of the telecom companies of Britain and Nigeria and will further enhance the stability for remote monitoring and control _____.

And for _____ displayed in this screen there's a logistic demand and capital requirement of the project. For Angwan Rina, productive users consume about 91.1 kWh/day and the average commercial electricity demand on an annual basis for the communities have been projected to be slightly above 278,000 kWh/yr. And in factoring distribution losses and other non-technical losses, we are projecting to have a total average electricity production of slightly above 300,000 kWh on an annual basis.

Coming down to the financials _____ succeeded in completing all the grid design system modeling, financial modeling for the project. At the moment, we are about currently in finances of the project subsequently we intend to commence implementation by _____ of 2017. As you can see the project has an equity—we are currently projected with finance with 162.4 thousand euros of equity and about 125,000 euros of long-term debt. Actually then _____ mostly we have the support of 200,000 euros finance support from the NESP which will be used for the distribution infrastructure in the community and also we are looking for other grants of an equity of about 362,000 euros.

At the moment, though, we're in discussion with a couple of early stage financiers, equity investors and also debt financiers. Recently, we're having a [inaudible] platform who will be financing the outstanding aspects of the project development. Most significantly the environmental and social impact assessment. And also we've been talking to some equity investors and for the debt we have already had Bank of Industry Nigeria who is the leading development financial institution West Africa as a member of the court and have to-date provided capital to the tune of over 600,000 USD for previous projects. So we're looking at further raising the debt capital from them.

Then also to-date we've also gotten grant commitment from the _____ Smart Village for half of the projects. Then our projects implementation timetable is as indicated. We've completed a feasibility, permitting, currently trying to reach financial closing and procurement and installation of project debt to come in in the first quarter 2017.

You can see here a brief snapshot of the system and also the distribution areas _____ for design. Both communities, because they are significantly a bit far apart, 2.5 kilometers and to prevent excessive line losses we decided to implement independent systems of 90 kW capacity in each of the communities, Angwan Rina and Demshin, respectively. And we have—we'll also be having battery storage and also diesel generators to _____ for big productive demand in both communities because of their high productive usage potential.

As you can see from the GIS snapshot of both communities, Angwan Rina and Demshin. From the snapshot you can see how densely populated both communities are.

And our business model—as a company I created two or three—three different levels of metering to come up with the current metering that we are using in our existing and future mini-grid styles. The metering technology is based from STS technology and they are also capable of doing two-way communication between the specific meter data concentrators to an online cloud repository.

In each of the meters the metering units are pole-mounted. They are the customer _____ as you can see here, are placed on the houses of the clients and we have _____ of one meter and a meter box, two meters and a meter box up to about six meters in the meter box. And interestingly because of the challenges of experience in the past in deployment _____ we also developed a measuring technology to be able to offer tried and true SMS technology as well as a SAS-compliant options like internet vending and also onsite vending as well.

I'm here projecting some of the financials of the project as I explained earlier, here as a display between the equity depth and grant aspects of the funds _____ focusing on the project. Of the cost the project is structured to be under split assets whereby fixed assets will be funded by grant and NESP which to a large extent drives the whole project. So with having the project IRR spread over 15 years of debt _____ and also an equity IRR of about 15 years _____ and the lowest debt service of our issue is slightly above 200 and average operating margins of the project is 22.7 percent.

And from the projects expected to have the breakeven of slightly above four years which is consistent with our previous pilot projects of being implemented in Nigeria. So that's all from me and I thank you very much for listening.

Eric

Thank you very much to all of our panelists. We've got a lot of great questions coming in. Just a reminder to attendees to go ahead and enter questions into the questions pane in the dashboard on the right.

In the event that we don't get to all of the questions we'll reach out offline to the attendees whose questions we didn't get to. And also just a reminder that we'll be posting all the presenters' slides on the Clean Energy Solutions Center website, so you can go and review them later.

The first question is about the National Electricity Regulatory Commission, NERC, and what are panelists' opinions of their draft min-grid rules is one question, and then another question about NERC I'll ask together is about the licensing requirements that are at the national level, and if any of the panelists think that state level government should get more involved to facilitate licensing.

Jannik

Can you repeat the questions?

Eric

The first question is about mini-grid rules and codes from NERC. And, the second question is about the role of licensing at the federal level versus

working more with state government to move forward with licensing for power systems.

Jannik

I can answer them not entirely but partly, I would say.

Codes—I think you're thinking about grid codes because in the future some of these mini-grids that we are implementing they will be interconnected mini-grids, meaning that the big grid will meet the small grid sometime in the future. We don't want the investment to be lost, and neither does NERC or the distribution company for that case. So all mini-grids have to be constructed in line with the Nigerian grid codes so that connection will be easier.

For the licensing, as long as the distribution lines are below 100 kW and the generation source is less than one [audio static] megawatts you are not required to get a license. But if you register at NERC and operate under the mini-grid regulation you will have all of these protections that you can get for your investment and then it will be easier for you to run your mini-grids. But you do not need a license for these mini-grids.

Eric

Thank you very much, Jannik. I think that answered both questions. There is a follow-up question that was directed to Femi but others may want to join in on the response here.

The question is what is the strategy for is the grid arrives within the next ten years, in other words before the breakeven point, and if the mini-grid is truly grid ready or if more net metering policy progress is needed at the national level. Kind of several questions in there all pertaining to grid arrival to mini-grid installation.

Femi

Can I comment? Just to tag along with Jannik said, the development of this mini-grid complies with the national code and framework for mini-grid in Nigeria. So we have looked at that possibility as well, which is a possibility. But looking at the consideration and the factors that you have to look at before a site is actually deployed for mini-grid you have to have minimum of about 30 to 50 kilometers away from the existing mini-grid. So with the current situation of power challenge in Nigeria there is no likelihood.

However, of course is _____ the donors. So let's assume that within this breakeven period that we have we have a grid connection. And that is the reason why we are already in discussion with Sokoto state government for [audio static]. I think in a couple of weeks that they will be meeting with the governor. However, because some of these other six sites that we've already identified and studied already have existing grid. We call those ones bad grid. For like six, seven years they have been grid-connected but no electricity has gone into those communities. So we are also looking at getting a permit or a license to also operate come of those existing communities. Even when there is a grid electricity or grid connection into those communities so we don't just lose out on it entirely.

So aligning our strategy and our work with the regulators and of course with the government is also helping to de-risk and to protect those investments that

we've put in, should there be a net metering as well. So we already have a plan to accommodate all of this.

Eric

There's a follow-up questions to that that one of the attendees asked, which is if—this is for all the panelists: if you could talk more about the role that grant funding plays in different startups in this space and what technical or commercial solutions might play a role in decreasing the role that grant funding needs to play.

Femi

If I quickly jump in before my other developer also contributes. We are a strong proponent to the fact that you don't really have to provide grants to make a mini-grid generation of projects viable or sustainable. When you look at what is going on here the grant component of what we have in some of the existing mini-grid projects they are not really going into subsidy. They are only derisking and also taking those portions that maybe you call it additionality now. So without an existing distribution connection in those communities.

So I need to now hope to double my investments into these regions to also invest in those class of assets that ordinarily I shouldn't be bothered. So if you take down an outsider then you don't really need a grant to make a mini-grid viable or sustainable. So we don't have grant components into the business aspect. So business capital funds actually come into projects. Like we have seven mini-grid projects. We don't have a single donor grant in any of these projects that we've implemented. Some of them are payback itself; some of them are still ongoing. So on the average grant is great to unlock or to derisk or to bridge the gap between what would it have been possible if not because of those grants availability? But largely you can actually say grant is really not needed today to operate a viable mini-grid project.

I don't know if someone else wants to comment.

Ifeanyi

Just to throw some light onto what my colleague has just elaborated, specifically for us we have a couple of existing sites. We have a _____ capital subsidy and the business model has been very consistent with our projections. So yes, a mini-grid technology can actually be very commercially viable without a grant component.

In some cases, as with some of the—for instance for the existing grid we try to understand that for a mini-grid technology it involves several level of investment in several assets, namely the generation asset, distribution asset, and _____ infrastructure which is not the case with conventional grid whereby generating companies only focus on derisk and the business model of just generating _____, whereas the distribution companies on the other hand just focus on that other aspect.

Eric

Thank you very much. The next question is about pricing and payments, there's two related questions I'll ask together. The first is if you can talk more about tariff models for projects. This is directed to GVE but others can jump in. And the other questions that's sort of related is how payment models are set up and the extent to which you do use or would like to use mobile money.

Ifeanyi

Thanks for the question. In Nigeria mobile money has been a bit tricky because of some regulations by the Central Bank of Nigeria. And graciously we've been working with several multilateral organizations such as GSME and a couple of others to see how we can raise awareness and provide some advocates and to unlock the use of mobile money, specifically in the use of daytime accounts for _____ in financially excluded regions of the country.

So at the moment at best mobile money is still not completely functional in the country. But we as a company have tried to see how it will work around existing regulations to ensure that we use available technology to provide service for us. For instance for each of the communities we operate we have local _____ agents who procure power for those involved and we provide an account for them now in our _____ platform whereby they can further vend power and retail power to our clients in the communities where we are operating. And in _____ we also have well-structured and innovative tariff model which is stratified. Commercial clients, different tariff level from residential and household client and also community clients are also on different tariff structure because of the level of power these various user categories use on a daily basis. I don't know if my colleague also has something to say about it.

Femi

Yeah, I likewise agree with the mobile money dilemma that we have. It's still at the very early stage. It's possible it works, however I think innovation as well has played a big role in helping us to get our funds, and to do that without spending more or losing revenue.

So for us at GoSolar Africa we currently have over 38,000 green entrepreneurs that we've developed over the years. So these entrepreneurs act as our agents across the country for different kind of energy-related business services.

So looking at the way mini-grid project is structured it's not that widespread across many states, many regions, simultaneously. So if we take the Kurdula project, for example it's just one location. A mini-grid in Niger State is just one location. So it's really mobile money traveling _____ a huge risk or make much difference than to innovate and come up with an innovative revenue collection or mobile payment collection model that suits.

So to add distributed _____ agents that we have we're able connect that with a service called Green Band. That Green Band can actually operate through SMS, and of course it works to another code that is generated. So this acts as the distributors that sell the unit of electricity to consumers, and like in finance centers where we have few among these green entrepreneurs that have as off-takers. So they're buying their electricity in bulk, and they are able to resell that to the same distribution agents. I think that is innovative enough and helpful. But over the—in the near future when we have more proliferation of mini-grid or interconnectedness then we have more regions coming upstream, then we might begin to look at the role that mobile payment and _____.

Some of our metering system also uses the SMS, the XTS code kind of metering technology, these supports that you can actually use an application on your phone to unlock and to recharge your electricity system for business or for home. So I think a mix of all of this is what we have to bring to bear when we are looking at what we have to-date and what is possible in the future.

Eric

Thank you both for those responses.

The next question is about especially the market sizing that each of you spoke about. It's directed towards Jannik to start but I think others may want to jump in.

Is how you determine the criteria for which subsets of the population mini-grid might be good for in terms of how far away from the grid they are, population density and so forth. That goes to Jannik first: how you decide who might be the best target for mini-grids and how many of such communities there are out there.

Jannik

We have done quite a lot of mapping on which sites could be identified for mini-grids. It started with a database on all communities in all of Nigeria where we had the coordinates and also the population size. We then had a map seen from outer space of Nigeria compiled over several months where we could see where they had light in Nigeria. And we have digitalized everything so that we can compare the different areas which have electricity with the different communities, cities or clusters as we call them.

Then we added all the information that we had on the electricity grid, the transmission lines and the distribution lines that we could get. And then we added data for un-electrified schools and for clinics, and there were several other sets of data that we recorded.

When you put all this on GIS you can have different layers on top of each other. And in the end you will discover that there are some communities which are far away from the grid and which have a population size suitable for mini-grids. And these are the sites we have identified.

I would also say that we might have identified 4,000 sites, however we have not verified their locations, meaning that if you are an operator and you want to do a mini-grid in an area you can of course use the data that we have to identify the sites, but you have to go yourself to the site and identify with your own eyes that this site is viable for mini-grids. It's only a guidance to where the sites might be.

Ifeanyi

To throw more light on that, if I _____, conserving _____ mini-grid in 2009 and completed six pilot projects we've come to appreciate the technical and commercial viability of the model. And in like with that we're currently working on an expansion plan to impact a million people over a six-phase plan. At the moment we've identified, in collaboration with the data from GIZ and other internal resources we've identified, assessed and qualified over 150

communities which across rural regions in Nigeria which are very viable for development of mini-grids.

Femi

Thank, if I may quickly—Femi here—for us we look at site identification: what qualifies a community for mini-grid. If you permit me we can look at that from two sides. So we're talking from the perspective of the government, or we are looking at it from the perspective of the people? So when government want to do good, they can choose to say, "GoSolar Africa, we want you in this particular community." But then if GoSolar Africa would really want to get into any community the first thing that we have to look at is the viability: is it viable? Can they pay for it?

So looking at that it's a mix of both but for any mini-grid to be sited I think it's very important that we consider those factors as viability, how much can they pay for the electricity? What use do they have? Most of the time while we moved away the ____ from solar home system it's simply because most new income costs the consumers. Also want to use refrigerator. They also want to use AC. They want to use every equipment.

At the end of the day their income cannot really pay for the tariff or for the electricity that they are asking for. So at the end of the day you find out that you put in a huge chunk of investment in those communities, it goes redundant and you are unable to get out of the jungle.

So for us we have to be sure that all this is actually very right, and that can be done by any company that wants to get into those communities to find out themselves. For us we work through our partnership with our green entrepreneurs. We don't go on our own to go and identify those communities but we rely on them to identify those viable communities we have our criteria and they can take that criteria to do the testing of those communities. Then when they find out that it's up to nine, over ten of what is required for GoSolar Africa to come in we can move in there to complete the feasibility study. But it's very important that we put it right, that it must be viable. It's not just something that is done out of pity that, "Oh, this region are not connected." So if government is coming in to support, to unlock some of those challenges that we enable the private sector to come in that is great. But without that I think GoSolar Africa just want to focus on those areas and communities that is able to make the business viable and sustainable.

Eric

We have time for just one more question. There's two that are related that I'll ask together.

The question is about local financing and what the nature is of relationships with local banks. This is more directed to GVE and GoSolar. You touched on it; if you could provide more detail on that.

Ifeanyi

I think I'll go first for GVE. For us, since inception to-date we've observed a significant improvement from the yesterdays to what we have now. Initially we had local banks who didn't understand the dynamics of energy access and renewable energy as a whole was, with the intervention of multilateral agencies such as GIZ or Power Africa and the like, through several levels of

capacity building. There's been a lot of transition with local banks now understanding the dynamics of that investing in renewable energy and energy access initiatives which require low cost of finance and significant, slightly longer turnaround than you have particularly for the commercial banks.

And speaking from one of our experiences we have been able to raise concessional debt finance to the tune of slightly over 600,000 USD from indigenous development, financial _____ institution, which is Bank of Industry, Nigeria. In 2012 Bank of Industry conducted a screening initiative to more or less work on or get to do several clean energy and renewable energy technologies out there in the country, and both GVE and GoSolar Africa are proud recipients and proud winners of that initiative. And subsequently they contracted Deloitte NTN manager to do the preliminary study of these initiatives, and further analyzing that, and through the help of several pilot projects that we've conducted they were _____ to the point that they were very convinced that this technology are technically and financially viable and that was the point where they actually invested.

And recently, just last month, they went into partnerships with UNBP under a two million UAV fund, specifically targeted to enhancing energy assets in the country. From four to six years ago, from an unknown to what we have now we have local financiers that are beginning to invest in clean energy and renewable energy projects.

Femi

I think banks in Nigeria were literally created not to finance businesses. And for us and for SMEs and for businesses at times you only get their attention to put money in your business if you can show to them that you don't need debt. So that is a kind of [crosstalk] in our own case. We got the fund support for our mini-grid as well from an eco-bank like GBZ and we also work with the central bank. I think they looked at a particular very fantastic fund that I will go for rather than going for any USD-based kind of finance that make the business so cool and very interesting and while a local fund may be very, very important.

But I think it's an evolution. It's evolving in Nigeria. We have a banking system or a financial sector that do not understand anything about what renewable energy is all about. They don't have actual information about how the market works. So they can't even structure a particular finance to support that sector.

So we have the likes of Eco Bank that is leading most other banks in Nigeria that we invested so much in developing capacity on their own. And I think other banks are literally trying to put up now to join in them as well to begin to put funds into renewable energy business.

I think largely it's a new tariff for them, especially that the sector is highly risky and then that is why the work of GIZ, the work of USAID _____ and other development partners is so critical at helping to take up some of the pilots that we've seen in testing the markets and ensuring and making that proof to them that this is possible, and of course there are some literal successes from some of the developers, as we are sharing our own success

today, that this is actually a sector that is viable, that is possible, and that can scale for them.

Pilot is not enough, finally. We need to begin to identify the critical mass in order for us to scale. So scaling doesn't come by piloting. So we need to know transcend from pilot into building the critical mass, and of course connecting in a single year a million, two million, five million people toward the energy that they need. And for now I don't see local market or local financial institutions being able to support that, also noting that the dollar forex issue in the country—and most of this investment you still need to take out these funds in dollars or euros for you to acquire the hardware that you need to implement those projects.

So this also still shows that we might still, for the meantime, depend on more funds supporting the local momentum. Maybe the component of the working capital aspect of it can still be taken care of, but not the pilot. The real solution should be how do we build the critical mass and face this massive scale up of mini-grid.

Eric

Thank you very much. We've run a bit short on time so we're going to need to jump to the survey. But I wanted to say thank you again to all of our panelists. That was extremely informative and a great question and answer session.

We have five short questions for you to answer. Your feedback is very helpful to us in improving this as we go forward.

The first question is, “The webinar content provided me with useful information and insight.”

The next question is, “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 another thank you to our expert panelists and to our attendees for participating in today's webinar. We had a great audience and we certainly appreciate your time. I invite our attendees to check the Solutions Center website if you would like to view the slides and listen to a recording of today's presentation as well as other previously held webinars.

Additionally you will find information on upcoming webinars and other training events and we are not posting webinar recordings to the [Clean](#)

[Energy Solutions Center 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.

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