

Implementing a Quality Assurance Framework for Microgrid Performance Monitoring in Africa

—Transcript of a webinar offered by the Clean Energy Solutions Center on 13 February 2019—
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Webinar Panelists

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Sam Duby
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Philip Voris 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 telephone, 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. If anyone is having technical difficulties with the webinar, you may contact the GoToWebinar help desk at 888-259-3826 for assistance.

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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 Resource Library as one of many best practices, resources reviewed and selected by technical experts.

Today's webinar agenda is centered around the presentations from our guest panelists Katrina Pielli, Sam Booth, Sam Duby, and Emily McAteer, who have joined us to discuss implementing QAS components in broader efforts to standardize performance monitoring across the microgrid sector in Africa to help the sector grow and attract investment.

Before we jump into the presentations, I will provide a quick overview of the Clean Energy Solutions Center. Then, following the panel's presentations, we will have a question and answer session where the panelists will address questions submitted by the audience. At the end of the webinar, you will be automatically prompted to fill out a brief survey as well, so thank you in advance for taking a moment to respond.

The Solutions Center was launched in 2011 under the Clean Energy Ministerial. The Clean Energy Ministerial is a high-level global forum to promote policies and programs that advance clean energy technology, to share lessons learned and best practices, and to encourage the transition to a global clean energy economy. Twenty-four countries and the European Commission are members, contributing 90 percent of clean energy investments, and are responsible for 75 percent of global greenhouse gas emissions.

This webinar is provided by the Clean Energy Solutions Center, which focuses on helping government policy makers design and adopt policies and programs that support the deployments of clean energy technologies. This is accomplished through support in crafting and implementing policies related to energy access, no cost expert policy assistance, and peer to peer learning and training tools, such as this webinar.

The Clean Energy Solutions Center is cosponsored by the governments of Australia, Sweden, and the United States, with in kind support from the government of Chile. The Solutions Center provides several clean energy policy programs and services, including a team of over 60 global experts that can provide remote and in person technical assistance to governments and government-supported institutions, no cost virtual webinar trainings on a variety of clean energy topics, partnerships building with development agencies and regional and global organizations to deliver support, and online library containing over 5,500 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 tech organizations in all countries, but we also strive to engage with the private sector, NGOs, and civil society.

The Solutions Center is an international initiative that works with more than 35 international partners across its suite of different programs. Several of the partners are listed above, and include research organizations like IRENA and the IEA, programs like SEforALL, and regionally focused entities such as the ECOWAS Center for Renewable Energy and Energy Efficiency.

A marquee feature that the Solutions Center provides is the no cost expert policy assistance known Ask an Expert. The Ask an Expert services matches policy makers with one of the more than 60 global experts selected as authoritative leaders on specific clean energy finance and policy topics. For example, in the area of mini-grid standards, we are pleased to have Ian Baring-Gould, manager at National Renewable Energy Laboratory, serving as one of our experts.

If you have a need for police assistance in mini-grid standards 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 form at cleanenergysolutions.org/expert. We also invite you to spread the word about this service to those in your network and organizations.

Now I'd like to provide brief introductions for today's panelists. First up today is Katrina Pielli, who is a Power Africa senior energy advisor and lead for Beyond the Grid, with the US Agency for International Development, USAID. Katrina leads Power Africa's off-grid energy access team, Beyond the Grid, focused on adding 25 to 30 million new household and business electricity connections in sub-Saharan Africa through off-grid energy solutions, household solar, and mini or microgrid technologies.

Following Katrina we will hear from Sam Booth. Sam Booth is a senior project leader at the National Renewable Energy Laboratory. He is currently working to support the Power Africa Beyond the Grid program with microgrid deployments, and has worked on numerous other international projects, such as off-grid studies in Indonesia, renewable energy development in Haiti, and microgrid development for the Defense Department.

After Sam, we will here from Sam DUBY, who is TFE Energy Africa's director, based in Cape Town, South Africa. He is an expert in appropriate design and implementation, leveraging PAYG, community and cross-sector engagement, and financial studies focused particularly on the energy access and frontier technology space.

And our final speaker today is Emily McAteer, who is the CEO and cofounder of Odyssey Energy Solutions, and a software platform—pardon me, a software platform that is simplifying, streamlining, and reducing the costs of developing and financing rural electrification projects around the world.

And with those introductions, I'd like to welcome Katrina to the webinar. Katrina?

Katrina Pielli

Thank you for that. And thank you, everyone, for joining us today to talk about the quality assurance framework.

So for folks that aren't familiar, Power Africa is a US-led initiative that captures 12 US government agencies, 17 international donor partners, and over 150 private venture and investor partners. The Beyond the Grid initiative

is specifically looking at the off-grid energy access pillar within Power Africa. Next slide, please.

Power Africa has a main goal of doubling access to electricity across the continent, and we also have three pillars to achieve that goal. The first is adding 30,000 new megawatts. The second is 60 million new connections, which is where Beyond the Grid fits. And the third is unlocking energy sector potential through the enabling environment. Next slide, please.

This just further illustrates the split between the way that we are focusing our efforts, and then the next slide specifically talks about Beyond the Grid. We have a sub-goal within that 60 million top line to facilitate 25 to 30 million off-grid connections by 2030, and we as an initiative were launched in 2014 in Ethiopia, and currently, we have over 60 investors and practitioners that are committed to over \$1 billion. And we're really looking at unlocking investment for private sector to really bring and accelerate off-grid energy access across the continent. Next slide.

So we have these very ambitious goals, and where we are today, both on the on-grid and the off-grid side, is shown here. So we're at just about 12 million connections as of the end of the calendar year from the off-grid side, and just about 700,000 from the on-grid side. And I'm happy to tell you that since then, we've added a little bit more, and we're actually at just over 12 million today from off-grid solutions. Next slide.

And for us, off-grid solutions means focusing on two things. One, solar home systems, so really trying to accelerate household level energy access, and two, mini-grid, so trying to facilitate community-level solutions. And for us, we use the term mini-grid and microgrid interchangeably, recognizing that the sector does as well, specifically in Africa. Next slide.

The heart of our program is our off-grid energy advisors. These are our experts that are scattered across the continent—you can see here. And these experts provide support specifically to governments, other investors, and off-grid companies. And I'm happy to say that in partnership with this network of off-grid advisors, we also work closely with NREL and Sam Booth and Ian Baring-Gould, who we'll hear from later today, to help ensure the quality assurance framework, specifically to target our mini-grid opportunities as we see them across the continent.

So now to go a little deeper—next slide—on the specific types of assistance that we provide, so starting with our assistance to the off-grid companies themselves, this involves helping with streamlining their distribution channels, helping introduce them to new local distributors, helping them refine their business models, looking at different marketing and strategies to help really bring them into different parts of the country, helping them enter a new country.

One of our most popular requests is helping them access finance, so this can be through assisting with different applications, helping to frame applications, making them aware of new opportunities. We do not write applications for

companies, just for the record. And then we also work with them and _____ and _____ to help with policy changes. So we want to make sure that the regulatory environment is supportive for private sector companies to come in and offer sustainable, affordable solutions. Next slide.

Working with government, a lot of what we do looks at bringing together recommendations and lessons learned from other policies that have been successful, or not, and sharing that with the policy makers and our constituents. So a lot of what we do here is working directly with them to do capacity building and linking them up with their peers or other lessons learned.

Here, we also _____ asking our support for the QAS under our technical standards, and again, that quickly leads into supporting more integrated planning and broader rural electrification approaches across the country. Next slide.

Within the BTG, Beyond the Grid, we also work in a couple of strategic initiatives. So the first one is Scaling Off-Grid Energy. This was a grand challenge started by USAID, but it includes a number of other key partners, and it's focused on helping Power Africa from our vantage point _____ solar home system goal, but more broadly, it's helping to bring together the right stakeholders to accelerate solar home system connections. So here, we work closely with the African Development Bank, with _____, with Shell Foundation, and also with Acumen Renovation Foundation, Microsoft, and others, _____, and this is a really exciting initiative for us, because it allows us to bring the whole ecosystem together and coordinate our efforts.

And then the second item that you see is our Smart Communities Coalition, which is something that we co-chair with MasterCard. And the idea here is to bring in new technology and partnerships solutions that are right now focused on Kenya and Uganda, but we have ambitions to go much broader than that, looking to bring in connectivity, digital tools, and energy access in new ways that would allow services to be delivered more efficiently in refugee settlements, and ensuring that they have access to quality, affordable products as well, both on the energy side and on the digital tools side. Next slide.

Here you'll see a quick snapshot of some of the work that we do with our fellow interagency US government partners. _____ doing work, as I just mentioned, on the quality assurance framework with NREL, and now partnering with TSE and Sam Doby to advance this in Nigeria, and also working close with Emily on the Odyssey platform kind of broadly, but also in a couple of target countries. So really, we're keen to partner where we can. You'll also see that showing up here when we talk about Global LEAP, which is really a recognized brand advancing off-grid efficient appliances. Here, we partner with DFID on a results-based financing. We partner with CLASP and the World Bank _____ Global—sorry, World Bank _____ Lighting Global, to make sure that we're advancing these quality products and driving new products into the market. So this refrigerator competition, we have a solar pump—solar water pumping competition open now.

USTDA, US Trade and Development Agency, provides grants. We at USAID, we provide grants as well, but also training and capacity building.

US Africa Development Foundation provides small grants to African-owned enterprises, and here, we just teamed up with them on a specific grant window for the Smart Communities Coalition, so they'll be announcing grants in Kenya and Uganda soon. They also just recently announced a window in Nigeria _____.

Finally, World Bank, AfDB, and OPIC are leading energy lenders in Africa, and we're happy to say that we partner closely with them as well. OPIC has issued a number of loans to support the off-grid industry, including Lumos and SunFunder.

So that was a very, very quick run through our program. Next slide.

Here's some links. Please reach out if there's questions. We're happy to talk with you. And we're really pleased to be able to be part of this specific webinar that brings together so many of our partners to talk about the really exciting work that they're doing to help standardize and drive forward the mini-grid sector from our perspective in Africa, but it certainly has implications broader.

So with that, I will turn it back over to NREL.

Philip Voris

Thank you so much, Katrina. I'm now going to pass this over to Sam Booth. All right, Sam.

Sam Booth

All right. Thank you, Philip, and thanks, Katrina. So again, I'm Sam. I work at National Renewable Energy Lab. We're a Department of Energy lab, for those of us that don't know us. And we're part of the US government Power Africa consortium. And we're working specifically on the mini-grid sector in support of the new connections and the scaling of the mini-grid sector, largely focused on implementing a quality assurance framework for mini-grids that NREL developed in 2015 and published in 2016. And really, what implementing that framework means in kind of more practical terms is there's really three things that we're primarily working on.

The first is working with developers to provide specific types of technical assistance. So this can be things like support for commissioning systems and developing good commissioning plans, techno-economic analysis for selection of batteries, and the tradeoff _____ between lithium ion and lead acid batteries, productive use of energy and how to evaluate the opportunities there.

Those types of efforts kind of feed into our second one, which is a publication of reports to support stakeholders in the industry. A lot of those technical assistance projects turn into reports, and then some of those reports are a little bit broader in terms of the topics they cover. So performance monitoring is another report we're working on, in cooperation with Spark Meter, and kind of the focus of this webinar. So I'll talk a little bit about performance

monitoring, kind of good practices, and introduce some of that Spark Meter data. And a third part is really working with government entities to help develop the enabling environment both directly and with small assistance to partners like Sam and Emily that are implementing similar things elsewhere.

So I wanted to start out with a little bit more background on the quality assurance framework. So NREL developed this originally to basically help lay the foundation for successful business models in the mini and microgrid space. Essentially, this is a space that we've been working in for decades, and the issue that we saw was that the systems kind of inherently looked like one off systems. There was one system here, kind of one system there. They were built a little bit differently. People talked about them a little bit differently. They reported on them differently, so that the sector wasn't really able to grow and scale.

And we wanted to try and support the sector to grow in scale to get to those universal energy access goals at the UN and the World Bank and others have, so really reaching that level of scale requires moving from—and we've gone from the kind of ones and two systems to developers now let's say with tens and twenties of systems. But to get to those goals, we really need tens of thousands of systems, and so something on the order of \$50 billion a year investment.

So the QAF was really designed to help lay the foundation for getting some of that investment and developing viable business models in the sector, providing structure and transparency for the sector, and standardization, but while also recognizing the sort of unique challenges of the off-grid sector, and that there's various kind of segments of the consumer base, and they might not all need the exact same thing.

But the focus of the QAF and the focus of this effort was basically to bring some lessons from the utility industry, which has been very successful in basically reducing risk, sourcing low cost capital, and growing. And the three kind of key stakeholders that have made utility investment such a viable investment are consumers, who basically need a guarantee of service that they can afford and are willing to pay for; power suppliers or utilities in this context need to guarantee a rate of return for their investors, while also covering costs; and the investors need to understand the risks they're taking and be willing to invest in the sector.

So in the utility space, this is a pretty well-established portfolio, but it kind of breaks down in the mini and microgrid space, and the reason it breaks down is related to the high cost of power—some of the reasons, at least—to remote customers, and that providing power to these remote areas often costs more than the national grid, while it may be cheaper than existing supplies of energy, like kerosene. This has implications for policy.

So one of the things we worked on in this space is a report on tariffs, looking at basically options for tariffs. Another issue in this sector in general is that there's a lack of kind of understanding of the cash flows and the revenue profiles from customers, particularly how they're going to grow and how

that's going to look over let's say the 25 year lifetime of a system. And these lead to sort of a poorly understood and high perception of risk in the sector, which is inhibiting investment.

So the QAF was really designed to help address some of those issues with two main things. First was define levels of service for variables like power quality, power availability, reliability, and this goes back to the idea of basically ensuring that the customers know what they're getting, the utilities are providing that service, and that it's kind of tracked and monitored and everyone has more confidence in the system as a whole, and investors understand what's being provided.

Part of that tracking and monitoring is really the accountability framework, and that's what we're talking about here today. So performance monitoring of power systems, performing some basically technical and business metrics, and how do those metrics get reported to various stakeholders, and helping to standardize that across the industry, to help it grow and scale.

So I wanted to provide just a little more background on kind of what performance monitoring is. So this slide is really sort of a generic performance monitoring process. If you take this and apply this to a variable in the mini-grid sector, say system load growth over time, that might be our goal. So we want to know how load in microgrid systems is growing over time. Process for this might be that we're going to measure this on a monthly basis. We're going to look at last month to this month, and we're going to get this meter and get this data from let's say a smart meter. We're going to analyze the data, see how it's grown, distribute that information to the various stakeholders that might be interested in it, from regulators to technical systems designers, or perhaps folks that are working to stimulate demand in the system. They're going to evaluate that data and maybe implement changes or fixes.

So that's just a small example, but it's basically a cyclical process, and you need to really define all the parts of the process before you can jump into the process.

I'm going to show a couple of examples from our work with Spark Meter, starting out with basically here are the QAF definitions for power and energy, very similar, and based on the World Bank multi-tier definitions, but basically showing the various levels of possible service for a microgrid from a power draw and an energy consumption perspective.

We did a project in cooperation with the Spark Meter essentially to look at operational data for 36 microgrids in Africa with about 4,600 meters, really just to show the potential of what you could do with this data, how you could gather this information, and sort of the insights that you could draw from it. So I have a few examples from that. This slide here shows the first one. So the top two bars are energy consumption and power consumption, and the colors are basically different QAF levels. So the majority—and this is on a per meter basis of the energy or the power that's being consumed at either sort

of a level one or a level two. So these are relatively low levels from that last slide.

But the power that's being provided by these systems is generally a little bit higher. It's a level four. So the takeaways—you could take a few different things from this. One—but the key takeaway, probably, is that the power availability is higher than the power or energy consumption for these systems as a whole, so you could take this as the developers are projecting relatively large levels of growth over time, and people are going to grow into that level of availability, or that the systems are being over-designed.

So it takes a little bit more insight and information to really understand that, but it's an example of sort of portfolio level analysis that you could do.

So another example is basically looking at voltage. So the top chart looks at voltage based on QAF definitions, and it's looking at the worst performing day. If you look at the worst performing day across this portfolio of systems, it would look like there's a lot of kind of low performing systems, maybe half level 3/4, and half level 1/2. And that's because you have systems that have maybe a year of data, or at least six months of data, of operational performance, and you're looking at the worst performing day.

Now if you look at the chart below it, you actually see that on a daily basis, most of these systems are performing pretty well. They're performing at a high level one. And the reason I wanted to show this is there's a key difference here, is how do you define your metrics. So if you're not defining your metrics appropriately, you might be getting results that don't quite look like they should, or that are kind of unexpected. So take care in kind of defining your metrics, and also take care, and once you've defined those metrics, make sure you look at the data, and make sure it makes sense to you and that it's kind of tracking what you're expecting to see at sort of at least initial quality check and quality control.

The next slide shows performance monitoring at a systematic level. The chart on the top left basically shows the voltage performance of a system on an average day. The blue lines are averages, and then the dark gray is sort of the standard deviation over the course of the data we have. If you're looking at your _____ or you're looking at the voltage performance of the system, one is about what your set point is. That's about where you want it. So if it's consistently high. You might want to review and adjust the generator set point for this system.

You're looking at the chart on the top right. This is frequency performance. Again, you probably set this and want this at about 50. You see some—generally, some spikes during a certain period of day. You might want to investigate what loads are turning on or off around that time that's kind of driving the performance of the system.

Or the third one on the bottom left is looking at the load profile for the system, so we see kind of a peak in the morning, and a peak in the evening,

not too uncommon. But you might want to look for opportunities to shift load to the middle of the day.

So just some examples of what you could do with kind of systematic levels of data and how developers can derive insights from that data.

The next slide shows kind of an example of what you can do with customer level data. So the customer level data is really the load profiles you see on the left. This is from the NREL performance monitoring report, and it's basically—these are the load profiles of various productive use opportunities or entities for a microgrid. So if you're a developer and you're looking to shift load to a certain time period, you might look at these profiles and say, oh, this is the kind of business I might want to encourage. Or if you're looking for maybe a more steady or flat profile, you might want to look at that. And then you can also look at, if you're an entrepreneur, this kind of information to help understand how your business is operating and how you might basically either improve your business case, and then you can also use this level of information to sort of evaluate the impacts potentially of some of the electrification efforts. So just an example of what you could do with kind of customer or load level data as well.

Here's a list of some of the resources I mentioned. I won't go into these in too much detail, but they can all be found on the web, so opportunities to look at tariffs and how to design tariff policy, how to look at the technical and business considerations for productive use, how to scale and grow the industry through financial and operational bundling, customer agreements, and a few more—the Solutions Center page with all of the QAF documents, our report with this full detail on best practices for performance monitoring, case studies in cooperation with Energy for Impact, and then a full suite of this data analysis in cooperation with Spark Meter to be published soon, along with reports on the techno-economics of batteries and battery selection, and utilizing surveys for predicting demand.

So thanks for joining, and I'll turn it over to the next presenter.

Philip Voris

Thank you very much, Sam. And I'd like to remind those listening today that as we do have two Sams here, Sam Booth and Sam Duby, if you have a specific question for them or any of the presenters, please be specific about the person you're asking the question to, if possible. Thank you.

And with that, I'll pass the baton to Sam Duby. Sam?

Sam Duby

Thank you, everybody. I am going to tell you a little bit about the work we've been doing to try that QAF that the other Sam so eloquently described to you, to actually apply it in a real world context, in this case in Nigeria.

First of all, I'm going to tell you a little bit more about my company, as requested. TFE Energy is headquartered in Munich, Germany, and we have offices in Cape Town, South Africa, where I run the Africa desk. Much of the work in Germany is for middle stack companies like Siemens, Knauf, and

ABB, around managing their energy transition. A lot of this is to do with electric vehicles, the internet of things, the march of digitization.

Since I set up the Africa desk about a year and a half ago, we do ever more work on this continent, largely around energy access in sub-Saharan Africa. We are also, of course, watching the unfolding situation in South Africa very closely. I'm not sure if this news hits the outside world, but Eskom, the national utility here, is also one of the biggest utilities in the world, in terms of generation capacity, and it's crumbling fast. I'm actually an energy refugee today. I had to escape my office because of load shedding. So I've actually tried to find a bit of electricity somewhere else.

But this slow I guess crumbling of the utility also presents quite a lot of opportunity, obviously, what with the incoming deregulation. There's a lot of scope for business around peer to peer energy trading and micro utility models. It's certainly something we're got our eyes on.

Now I come to the team after nearly seven years in Kenya, where I cofounded SteamaCo, building microgrids in places like this, in the middle of Lake Victoria. And as I'm sure some of you in the audience can appreciate, this presents one or two challenges from how to actually get equipment to this island in the first place, to how to manage and monitor the assets once they're there, how to get people on the island to pay for your services, how much they should pay, how to stop the solar panels growing legs and disappearing overnight, how to navigate local bureaucracy, how to raise capital, etcetera.

Now this obviously gave us quite a lot of hard-won experience at the _____, as it were, and this has been massively valuable to the work that we're currently doing.

So back to the present and what we're currently working on. Over the last year or two, we have analyzed survey data from a huge number of off-grid sites in Myanmar, trying to piece together a methodology for selecting the best sites for a microgrid. We've looked at off-grid markets in Ethiopia, Papua New Guinea, and across the developing worlds. But I'm going to tell you about a few of the projects we're currently working on.

The first is VIDA, which is an abbreviation, Village Data Analytics, which began life as a project for the European Space Agency, looking at how their legacy data and technology could be used for the betterment of the off-grid energy sector. It's now evolving to be more of a thorough toolkit to gather village level intelligence. Now this can be applied to anything from prospecting for suitable microgrid or mini-grid sites to tracking the impact of building clinics across a region, for example. We're working with several microgrid developers on this and state organizations, and it's proving to be really exciting work.

And another project I want to mention briefly is one that we're doing for the German Ministry of Economics and Technology on the increasing use of digital technologies in the energy access sector. It's a fascinating story that I'm sure many of you are familiar with, a lot of which comes back to the way

the mobile phone revolutionizes so much in Africa, from leapfrogging communication infrastructures to mobile money, allowing unbankable people living in villages to remotely pay for services.

And arguably, the off-grid industry as we know it today would not have been viable without these extraordinary breakthroughs, which it's very often—it's very easy to take this for granted sometimes. We're now a few years on, and innovation is continuing apace, and we're trying to catalogue that and interview some of the more innovative companies. This report will be published later on in the year, and freely available. So if you're interested, stay in touch.

But the most interesting mandates, and obviously, the one relevant to this webinar, is the work we're doing for the QAF, which is a mandate for the African Development Bank. And as I mentioned previously, it's about the practical implementation of this NREL-developed QAF to very specifically the Nigerian context.

The first part of our work was essentially trying to get a stakeholder landscaping done, looking at who were the stakeholders in Nigeria, what their various needs were. So we spoke to as many people as we possibly could from NERC, the Nigerian regulatory, through to the rural electrification agencies, through to local developers, international developers, AMDA, all sorts of people that were exposed to this sector in Nigeria.

And this means—and very quickly became apparent that it means that we have to very carefully tread the thin line of trying to meet as many of the needs of the various stakeholders as possible. So in the example of NERC, they have very specific regulatory compliance monitoring requirements, all the way through to being able to offer value for developers, and obviously not bogging them down with too stringent reporting expectations, and also not, and this is critical, not excluding small, often indigenous developers, many of whom might not have smart meters or complex, sophisticated remote monitoring equipment. It's very important to make this as inclusive as possible, and obviously, that is somewhat easier to say than to do.

We've been working very closely with Odyssey on this. You'll hear a little bit more about that in a minute. And so far, this has been a very symbiotic relationship. Odyssey obviously bring a lot of the technical know-how and heft. We bring more of the on the ground contextual know-how. And they're building relationships, trying to get people into the room. We've had excellent support and buy-in from the Rural Electrification Agency and NERC, the Nigerian regulator, so far, which has been absolutely indispensable, and shows that they at least have some inkling about the value of this exercise.

So we've taken the NREL QAF, and we've developed a modified version of it with modified metrics, and also a teaching curriculum to train the developers, the local Nigerian developers, and the communities that they intend to serve.

Now this last piece is particularly important, as often, a rural consumer does not really have much agency or recourse to action if their products or services

they're consuming don't meet their needs. And we believe, and we're obviously not the only ones, but we believe that for the off-grid sector to flourish, these communities, these rural consumers need to be empowered, to a certain extent. They need to have a voice.

And so as such, a lot of our work has been to develop trainings for the recipient communities on things like the complaints procedures, the service delivery agreements that the developer has to sign with them, the mandatory formation of consumer groups, and mechanisms to ensure that they're getting the service they're paying for.

Now interestingly, in Nigeria, and I'll touch back on this later, but in Nigeria, a lot of this is required by the regulatory body in order to operate there. So whilst we're trying to create a framework for the compliance monitoring, we're also trying to increase the capacity of rural consumers to be able to pay—sorry, to be able to complain.

Now, obviously, this is a massively complex issue, because private mini-grid developers cannot and should not be held to more stringent accountability than other utilities. Otherwise, simply the industry is never going to get off the ground. Likewise, a lot of the information and data that's been requested by the Nigerian regulatory is commercially sensitive. As such, a lot of our work has been to make sure that the reporting protocols are straightforward and as automated as possible. Data sharing, security, and permissions, such as who gets to see what, is critically, critically important, as is the communication of this to as many stakeholders as possible.

Lastly, although this work is focused on Nigeria specifically and the Nigerian regulations, we really are trying to set a strong precedent that can be applied elsewhere. The next step is that we're going to be working with Nigeria developers directly. We've already started the first training, and this is always the point where the theory becomes practical and things become interesting. And we've been getting quite a lot of feedback already. Some of the more immediate feedback that we've been seeing has been stuff that we could probably expect, things about data, who sees the data. There's been a lot of skittishness around that, who sees it, how secure it is. And this is something that we've seen echoed in various parts, with our conversations with AMDA, the Africa Minigrid Developers Association, who represent the sector in Africa, and from international developers as well, which underlines the importance of that data security and that compartmentalizing of information.

Also, interestingly, we're starting to get some calls from developers in Nigeria to include other metrics that we haven't actually thought about yet. Some of these are around the more social and environmental metrics. It seems that there's a strong desire to communicate some of the wider positive impacts of mini-grids. And so this is interesting, and not something that we expected.

Over the next few months, we're going to be working very closely with these developers in Nigeria on their sites. We're going to be taking them through some of the community engagement processes, again, getting them up to speed with how the QAF can be beneficial to their business. A large part

of the adapted framework, and also their inherited framework, has been about how to create monitoring protocols where people can actually see how well their business is running. A lot of the smaller developers might not have this in place, but metrics like ARPU, operating margins, and such like, and keeping an eye on them, is obviously critically important to your business.

It's about capacity building in that way, both in terms of the importance of these metrics, but also how they can monitor them closely. Obviously, Odyssey is going to be the mechanism by which they do that. There's a lot of onboarding that needs to happen in order to even get this process off the ground.

We're anticipating that this work is going to mean there's a lot of evolution and iteration to the QAF, and we're very much open and hoping that that will take place. And one of the key drivers for getting this right is the application of these protocols to the results-based financing schemes that have been discussed by various parties, including the Africa Development Bank and AMDA and the Shell Foundation. It's hoped and anticipated that a lot of this QAF compliance is going to form the basis for RBF compliance, which is essentially a way of unlocking funding for a developer once they meet certain criteria, certain targets, for example, connecting up a certain number of customers.

Obviously, there's a lot of work that needs to be done before that can be in place, but we very much have that bigger picture in mind, and we're working closely with the Africa Development Bank and Odyssey to bundle all of this work and all of these lessons into a replicable and generic protocol that can be applied to other markets. We've got a couple in our sights, so what this space. This is very much an evolving protocol. And so we're very open to any input, and hopefully, we're going to develop something which is as valuable as possible to as many people exposed in this space as possible, and the fundamental bottom line is that we're really trying to catalyze the industry. So this is one of many battles towards that direction. And so yes, watch that space. Thank you very much.

Philip Voris

Thank you so much, Sam. And I'd like to remind those listening that if you have any questions, please use the ask question pane and submit them to our presenters as you wish. And for now, I'm going to pass the microphone to Emily. Emily?

Emily McAteer

Great. Thanks. All right. Hello, everyone. Thanks for sticking with us. Hopefully it hasn't been—it's been exciting enough to get us to the final presentation. I think Sam Duby did a great job giving a bit of a preview on Odyssey and the role that we are playing in the quality assurance framework implementation. So I'll spend this time sort of digging into the Odyssey platform a little bit and walking through the various ways in which we are supporting all of the quality assurance framework efforts that you've heard from the previous presenters.

A bit of background on Odyssey. My cofounder and I started Odyssey a couple of years ago, and we did it after spending a bunch of time in the field

as mini-grid project developers ourselves. Our realization was that software could play a really important role in getting mini-grids financed and built, and that's really our ultimate goal at Odyssey. We want to provide any sort of support that we can as a software platform to develop really good mini-grid projects and get them financed so that they can get off the ground and connecting customers.

The way that we do that is by bringing all mini-grid data into a single web-based platform. We really do this sort of end to end. Every single piece of data—this is our goal, is that every single piece of data that's collected at any stage of the project development process, it lives in the platform, it is made easily accessible to either the project developer who's implementing the project, or stakeholders with whom the project developer is interacting.

So a big piece of what Odyssey is about is a very secure data sharing architecture that allows project developers to share key performance indicators and other metrics with financiers, with regulators, and with other stakeholders with whom they're interacting on the project.

That data really covers every phase of the project development process, from the very beginning all the way through to operations. It starts with feasibility analysis, moves into sort of the type of data that's collected and shared in the financing process, and then moves into development and procurement and construction of the project, and then finally, and a big piece of what we do, and a big piece of our role in the quality assurance framework, is portfolio monitoring. So once those projects are up and operating, Odyssey plays a key role in collecting the data from those projects so that we can assess how the projects are performing.

So hopefully, it's clear from sort of how I've described Odyssey that the centralization and standardization of project metrics makes it much easier for stakeholders to implement the quality assurance framework, and that's really what we're trying to do with the platform. Our goal is to provide tools for project developers to follow quality assurance framework guidelines as they prepare projects and as they develop and implement projects, and then also for all of the key stakeholders who are engaged in the quality assurance framework, to monitor performance of projects and understand how those projects are performing vis-à-vis the QAF guidelines.

So just to give you a bit of a sense of the Odyssey platform, because there's a lot that goes on it, data lives in a few different or many different places within the platform, and the idea is that both at the organizational level as well as the project level, we are taking in various pieces of data and making them easily accessible to the stakeholders.

One of the key things we do is simply a project register, which you see all the way to the left of this slide. The idea is to have a single source of truth about all projects that are in a portfolio or in a pipeline. I log into Odyssey, I see every single site, every single project that I'm working on, and if I click into that, I get a full set of data from the very beginning of that project all the way through, if it's up and operating the metrics that's coming back to me from the

data feeds from the project. And that's really what we mean by life cycle data. Every project comes with a set of data modules. Those data modules are organized by life cycle, so we've got a set of data modules around feasibility analysis and predevelopment, a set of data modules around development and tracking how the project's rolling out, and getting commissioned, and then finally, what we call the operations data modules that are the data feeds coming directly from an operating project.

We also integrate file management into this. So sometimes data can't simply be calculated or input as quantitative data, but a key part of making sure that quality assurance framework guidelines are met is tracking certain files, such as commissioning reports, and making sure that those are accessible to the stakeholders who need to see them—and understand whether or not quality assurance framework guidelines have been met in let's say the commissioning process.

Finally, we've got the asset monitoring piece, which I'll dig into in just a minute, but again, that's the live data feeds that are coming from the projects.

To just kind of walk through this a little bit and talk about how we're integrating the quality assurance framework into each of these stages of the life cycle of a project, I'll start with the feasibility analysis. What Odyssey seeks to do is provide a standardized set of tools that helps a project developer streamline and systematize the way that they do feasibility analyses for all of their projects. It really starts with the site survey, so we've developed a mobile application that project developers can use to go out into the field if they're offline, collect data on customers at a site, on a community itself, and then automatically come back and synch that data into the Odyssey database so they have a single place where all of their survey data is living. And as you can imagine, that enables much more rigorous analytics, if they're using sort of software and the power of strong databases to collect all of their survey data.

That's actually the point at which they can start implementing the quality assurance framework. The quality assurance framework starts with a set of guidelines about how to survey communities and the types of metrics that could be collected, and the Odyssey survey tools is seeking to kind of adopt those guidelines into the way that we offer surveys to project developers so that they can make sure that they're implementing best practices as they go out and survey communities.

The project developers then use that survey data to come up with their load forecasts, and so that's the large screen that you just see on the left here, is an example of a demand assessment that's been created within Odyssey. Really, the main way that project developers do that is by segmenting different types of customers, applying sort of expected load profiles to those customers, and really building it up from the ground up or from the user up to understand what load at the entire site looks like.

Again, a lot of that comes from the analysis that they're able to do automatically in the platform from the survey data. When the survey data

links to the platform, they're able to view a set of metrics giving them some indicators about what types of customers are in the community and how those customers are currently using power and how they expect those customers to use power.

The nice thing about keeping all of that site information as well as load information in the platform is that it enables system design directly within the platform as well. So we plug into Homer's modeling engine to enable project developers to take in their load data and optimize the generation system for their project and determine what the optimal configuration of components is for that particular site.

The rest of the modules related to pre-development in Odyssey really play into the financial model. So there's a set of modules around distribution design and calculating the bill of materials for the distribution and customer connections, as well as sort of general soft costs that should always go into the financial analysis of a project. And then we have a robust tariff calculator that helps project developers understand how different tariff configurations will impact their financial model and how customers will essentially be paying for power.

And finally, what you get at the end of the day, once you've gone through that sort of workflow within Odyssey, is a very detailed financial model that gives as accurate predictions of key financials and unit [audio glitch] standard metrics, such as IRR, payback, and a number of other financial metrics.

Really, in going through this standardized workflow, the goal is to make all of these metrics easily analyzable across lots of projects. As you can kind of see here in this little video, what I'm showing is I've got a large portfolio of projects. These projects, potentially, if I'm an investor or if I'm a financier or a government agency, these projects might cross lots of different operators, and I'm monitoring these projects across different players within my country, but I'm able to easily understand sort of what the implications of this portfolio are. I can group the portfolio according to let's say state within a country. I can click into a project and understand how that project is performing. And I can compare projects across each other, so I can understand, okay, this project is giving me this key metric because I've made this decision about my design configuration, whereas I'm seeing a different IRR or a different expected load at this site, because of these indicators.

And that's really the goal here, is to finally provide a way to do apples to apples comparison and start to really understand what impacts the unit economics of these mini-grid sites.

All right, so now we get into the finance piece. So once the projects have undergone the standardized but rigorous feasibility analysis, the goal is to get the projects financed so that they can get built and implemented. And that's where Odyssey plays a role very specifically with the quality assurance framework, because our goal is that we are making—we are integrating the quality assurance framework into financing programs and making it easy for financiers to set requirements for financing around the quality assurance

framework. And Sam Duby mentioned this a bit in his presentation, but there's a number of efforts in the sector to develop very systematic subsidy programs built on the quality assurance framework that ensure that subsidies go to projects that are proven to be high performing mini-grid projects.

Again, what Odyssey is really doing in the financing process is taking all of the data that would otherwise live in many different places, in financial models, in pen and paper customer surveys, in exports from a smart meter, in a dot.homer file that's coming from the Homer software design tool, in hand-drawn technical or distribution network designs, and putting it all into a data layer that then a financier can easily diligence and kind of run through metrics and say, okay, this meets the requirements of my financing program.

We recently launched an exciting tool which we call tracker, which is essentially a multi-stakeholder project management tool that allows project developers and anyone sort of associated with the development process of a mini-grid to track all of the sort of key milestones and tasks of implementing that project. And we see that really helpful on the QAF front in terms of following some of the guidelines around construction and commissioning, and it's also a place where, you know, if a project developer could sort of make it clear that they followed certain protocols around commissioning and also upload and share information and files about the commissioning process.

And then finally, we get to system performance monitoring. What Odyssey does here is we take the data feeds from an operating project, and those data feeds, Sam Booth talked a little bit about these, but those might come from smart meters, they might come from inverters and system components that are—that are reporting back on system performance, and they might come from sort of post-operational or operational surveys that the developer is collecting as well.

We take all of those data feeds, and we bring them into the platform, and our goal is to create a easy to digest dashboard for stakeholders to understand how that system is performing according to the quality assurance framework guidelines. So we've been working very closely with the NREL team, with TFE, to sort of think through what's the best way to present the many metrics that have been designed and put forth by the various folks engaged in the quality assurance framework implementation, and to really make this something that's usable by stakeholders who want to understand the quality assurance framework.

One of the sort of next phases of this, we have a prototype out now that sort of collects a broad set of QAF metrics and brings them into the platform, but our next phase of this is to kind of put in a set of intelligent alerts that will tell either a system operator or let's say a regulator who's monitoring quality assurance framework performance when something is a bit concerning or there's an anomaly that needs to be looked into for a certain metric that might be sort of out of the accepted range of the quality assurance framework.

And again, really, the end goal of all of this is there's incredible work that's been done to standardize the metrics from mini-grids to put together a really

detailed protocol about what is a high performing mini-grid, what is a mini-grid that is reliably providing service to its customers? And Odyssey's goal is just to make that easy to implement, and to give the tools that all stakeholders in the sector need to put the quality assurance framework into action, no matter sort of what activity you're doing in the sector. So to implement quality assurance framework in the project development process if you're a project developer, to integrate it into a financing process if you're a financier, or potentially to integrate it into the reporting and monitoring aspect if you're a—let's say a government agency or an investor that's tracking system performance.

And I will leave it there. Thanks, everyone.

Philip Voris

Thank you so much, Emily. And thank you to each of our panelists for those outstanding presentations. As we shift to the Q&A, I'd like to remind our attendees to please submit questions using the question pane at any time. We will also keep several links up on the screen throughout for quick reference that point to where to find information about other upcoming and previously held webinars, and how to take advantage of the ask an expert program.

So we have some great questions here from the audience, and we'll use the remaining time to answer and discuss them. So let's start with a question that we can pose to Katrina. It is why does Power Africa see the QAF as important to the mini-grid sector? Katrina?

Katrina Pielli

Great. Thanks for that. So I think, as you heard particularly highlighted by the other presenters, this is a really critical tool to help drive standardization in the sense that it'll bring clarity and certainty for investors in particular who can actually really understand the different parameters, make sure that the specific information is being provided out by the mini-grid developers to their customers, and then reported back up to investors or funders, it's all using the same categories and definitions, and just really trying to provide that structure that we hope will provide investor confidence.

And then as you also heard from Sam Duby and Emily in particular, there is such opportunity for the QAF to serve as a rallying point for donors to actually think about how they can contribute to results-based financing, or standardize incentive metrics that would allow you to, again, drive all of the developers to be using a similar type of format, so that way, you're not actually as a donor or an investor comparing apples to oranges, when you look at what you're trying to fund or what information you're getting back from the developer.

So we see this as a really foundational tool that'll help bring the sector forward, and we see a lot of applications for it.

Philip Voris

Thank you so much, Katrina. I have a question now for Sam Duby. It is, with regard to Odyssey, what are the technology requirements of the mini-grid systems that enable Odyssey to track QAF-related metrics, and how do you handle data security and confidentiality?

Sam Duby

So this actually is probably better—

Philip Voris

I'm sorry. That was for Emily. My bad.

Emily McAteer

Yeah. No worries. Yeah, so data is obviously sort of the biggest issue that we deal with and think about. The ideal situation is that you've got a perfectly functioning microgrid that's sending lots of data up into the cloud, and we're able to pull it from the cloud and run analytics on it, and it's all sort of very seamless, and we can put those into a format that's easy to review in the platform. The reality is much different from that. A lot of these mini-grids are in rural areas that don't have great GSM connection, and so you'll see gaps in the data that can actually be extracted remotely from the site.

And then the other challenge is sometimes you're not able to do that all. There's not—there's no connection, so you can't remotely monitor these sites, or the technologies that we're using onsite don't permit that as well.

So what we've done with Odyssey is really try to make the platform as flexible as possible and make it possible to get data into the platform in different ways. So if there's a smart meter that does have let's say cloud-based data, we can integrate with that smart meter and pull that data securely into our database and run analytics on it, but if that doesn't exist, we also make it easy for project developers to come to the platform when they are back in—let's say in an area with data or Wi-Fi, and upload data that they've extracted onsite.

And we'll continue to kind of work on this in the field with developers, understanding what are their limitations to data collection, and how can we make it sort of as easy as possible for them to get data into our secure database, and make it possible for them to do the reporting that they need to do.

Philip Voris

Great. Thank you so much, Emily. Sorry about the confusion there. Now for the question I had for Sam Duby. It is what have been some of the challenges of implementing the QAF in Nigeria? Sam?

Sam Duby

Yeah, so we've—thank you very much for that question. We've touched on quite a few of these already, but I'd say some of the key challenges have been making sure that we get buy-in from as broad a cross-section of the stakeholders, both in Nigeria and outside of Nigeria, as possible. There's a certain amount of legitimacy that is required for us to be able to kind of gain access to a lot of these developers, and that has come from going in under the umbrella, if you like, of the rural electrification agency. It's meant that we've been able to access developers that we wouldn't otherwise have been able to access, and as I say, it's given us a kind of legitimacy that we otherwise wouldn't have had.

However, getting there, getting to that position, has not been a quick or particularly easy process. Obviously, there's a lot of onboarding that needs to be done, a lot of explanation that needs to be done, but we've got there, fortunately, and not only with the rural electrification agency, but also with

the national regulator. As you can probably imagine, working with the national regulator anywhere is tricky, but working with the national regulator in Nigeria or elsewhere in Africa is definitely on the tricky end of the scale. That's definitely been a challenge.

Another challenge has been around the capacity-building of developers. A lot of the developers—Emily was talking about the ideal case of data flooding in from smart meters, from all the developer sites. The practicalities and the realities are of a lot of these sites is that they're off the GSM network, so it's very, very difficult to get automated data from these sites. A lot of these sites do not have good internet coverage in any way, so there's very little scope for harnessing your data platform to APIs, for example.

So there are a lot of challenges, a lot of various challenges, which I think are going to be pretty much the same in other markets, but nothing insurmountable yet. Thank you.

Philip Voris

We actually received another question somewhat related to that. It was asking you to expand a little bit more on the details of interacting with local developers and how that can be done in an effective and understandable manner. I wonder if you could add a little bit more.

Sam Duby

Yeah, certainly. So I think there's no real substitute for face time, really. Engaging developers as much as possible over emails is great up to a point, but you really do need to be on the ground. You need to be able to understand what the context is that they're dealing with. You have to have a very clear idea of what their sites are like, what their own internal challenges are. I mentioned some of the ones around availability of phone networks. But there's also all sorts of challenges that developers then face themselves around community engagement, community expectations, their view on regulatory compliance.

So really, the simple answer to that question is to be on the ground, to be listening, to understand as much as possible how things look like on the ground and adapt accordingly. So as I say, we are just starting to process. We've done a lot of the work theoretically and a lot of the work developing materials for this, but really, there's no substitute for actually getting boots on the ground, so that's the next stage of the project, which is just kicking off now. I don't know if that answers your question, but that's the simple answer.

Philip Voris

I think that's great. Thank you so much. Now I have another question for Sam and also for Katrina, that is there have been some recent good reports _____ demand stimulation report, highlighting the need for demand stimulation to make maximum use of available supply. Given the data on over-sized systems and the challenges of receiving sufficient revenue to support mini-grid businesses, I'm wondering if anyone is engaged in demand stimulation activities. So we'll start with Sam and then we'll ask Katrina.

Sam Booth

So this is Sam Booth. I'll start. That's a good question, and I think there are lots of people engaged in those types of activities with varying degrees of success. But I've seen developers themselves, for the issue that was raised

of basically systems that have been oversized and growing demand, be very actively engaged in offering incentives, kind of time of use pricing, financing for appliances, so a variety of programs from a developer level to encourage demand stimulation. I've seen that. I've also seen a number of NGOs—I know Energy for Impact and Practical Action are pretty active in the space. So basically providing training to entrepreneurs to kind of grow productive use businesses for micro-grids.

And we've done a little bit of work, and I'm sure others have at a national level, of trying to think through if you're a government agency, say a rural electrification agency or an energy ministry, what might you be able to do or offer for demand stimulation around policies, incentives, things like that. I haven't seen programs rolled out at a national level yet, but I know people are thinking about it, so I'd say there are people engaged in that space. There's more work needed in that space, but people are engaged kind of across the spectrum. Katrina, I don't know if you wanted to add anything to that.

Katrina Pielli

Yeah, thanks, Sam. No, I think what you said is great, and just to reiterate, there is an increasing number of folks that are interested in that space, I think us included. We're actually bringing on a couple of new folks to cover the West Africa and East Africa region, to look at productive use opportunities in the _____ culture energy space, so you can add us to the list.

But certainly I think the question there had highlighted this is such a critical thing to get right as you think about designing new mini-grids, and so we're just really excited to see the number of new folks entering and specifically trying to drive forward ways to ensure that there's this economic growth paired with energy access, so that you actually are seeing people generate additional opportunities for themselves, as well as provide a sustainable revenue source for the mini-grid developer.

Sam Duby

The only other thing I'll add to that—I don't know if there was a particular Sam that this was directed at, but this is Sam Duby's response—is just to add that it's very critical to, as you would say in America, to bat smart and allocate your resources well. And a key part of that is making sure that your efforts to promote productive uses are taking place in the most fertile or appropriate places to do that.

There are some villages, there's some places which simply are not suitable for productive use stimulation, because there isn't enough local economic activity or there are some fundamental factors which are just not working. So I'd really advocate for on the ground research and also research before a project is implemented to make sure that any efforts that are made are being made in areas where they're going to actually be effective and efficient, because that's not everywhere.

Philip Voris

Thank you so much. Now the next question here is actually for Emily. It is your platform for private mini-grid developers only? Do you allow for the integration of already operating mini-grids into your platform? And finally, what is the best average IRR for a typical mini-grid project, from your experience? Emily?

Emily McAteer

All right. Yes. So Odyssey is not for private operators only. Odyssey is—the whole concept of Odyssey is that it's for all stakeholders in the microgrid/mini-grid ecosystem. So our users include mini-grid operators. They include government agencies that are running mini-grid programs in their country. They include donors who are running financing facilities, investors who are looking to make commercial investments in mini-grids, and then finally suppliers of mini-grid services and products. And that's really kind of our fundamental mission here, is to provide the tools for all of those stakeholders to interact in a very organized way that's data-focused.

There were three questions in there. What was the second one?

Philip Voris

Okay, so it was do you allow integration, I think you spoke to that, and also, best average IRR.

Emily McAteer

Oh, right. So in terms of integration, our sort of theory on that is to make sure that Odyssey integrates with a variety of technologies, and so we ourselves integrate with sort of the most common technologies that we see our users operating and using in the field, and then we also provide open APIs to make sure that new technologies can also integrate with our system. Again, we really are looking to standardize the way that data is presented in the Odyssey platform, regardless of what technology is being used in the field.

I'm hesitant to give any numbers around IRRs, because mini-grids are all over the books. It really depends on geography, on business model, on the community itself. And as a policy at Odyssey, we take data confidentiality very seriously, and so our goal is to provide a way to store and manage and communicate data for the organization that's inputting the data into the platform, and so we don't publish or even anonymize sort of the data that's in the platform. We simply sort of make it possible for the users who own that data to communicate that data to the stakeholders that they choose to communicate it to.

Philip Voris

Thank you so much for that comprehensive answer. Okay, I have a question here. This is actually for Sam and Emily, and that is I would like to ask them how reliable do you think that survey data are in order to make projections of energy consumption for rural communities?

Sam Booth

So I can start with that. I think—this is Sam Booth, but I think others can chime in, Sam Duby if he wants. There's been some research that shows that survey data is not particularly reliable for estimating energy consumption, in that it's hard to get people that haven't had access to electricity previously to really think about how much energy they're going to use in the future, and how much energy they're really willing and able to pay for, and what appliances they might project buying, and when they might buy them in the future.

There was a nice paper from Vulcan Energy looking at this, and this goes back to the issue of kind of why systems end up oversized, three, four times oversized in some cases. That said, I think there are better ways to do surveys than others, and I know a lot of developers have spent a lot of time thinking

about this and how to do proper demand assessment for systems, and that what questions you ask makes a big difference in terms of how reliable your survey is.

So we did some work with Carnegie Mellon University to look at this, and we have a paper coming out soon, basically looking at what questions are good predictors of energy consumption, so I can't share too much from that yet, but it should be out probably in the next month or so, and it's basically highlighting that certain things, like let's say income, types of house, are better predictors of energy consumption than others. And I know a number of developers have found that looking at actual consumption from nearby systems or villages with similar types of demographic characteristics has been a better predictor in some cases of consumption than the surveys themselves.

So that said, kind of a long answer to surveys are not great. They're kind of the best tool we've had to date, and they're getting better with the kind of analysis of the data and comparing the survey data to the actual consumption. So I think people are—have realized that that's an issue and are homing in on kind of maybe the better questions to ask to better predict consumption, in addition to looking at kind of actual consumption. And I know Odyssey's focused on that, so I don't—Emily, do you want to add to that?

Emily McAteer

Yeah. I guess there are just two quick points. One is I think the surveys really—the survey process really changes based on the geography that the site is in. So if you're—as Sam mentioned, if you're surveying a community that's never had access to power before, it can be very hard to kind of use indicators to understand how customers hypothetically would use power, if a mini-grid were put into the community.

In other places, and particularly in Nigeria, where we work, a lot of these communities actually have power in the form of diesel generators, and so the developers are going into these communities and actually seeing how people are using power today, which is helpful, because they've got a little bit more data on appliances that these customers are owning and times of day that they're using these appliances, although there's still a lot of sort of key factors that go into how that power use would change if they were presented with mini-grid power versus a diesel generator.

I think at Odyssey, as much as we love surveys, and we make it easy for project developers to conduct them and to manage all of the data for them, we are sort of operating under the assumption that survey data is—we don't quite know what to make of survey data yet. And what we really need to do is collect a very large operating set of projects that collected survey data in more or less the same way from the beginning, went and built the projects, and then started collecting operating data in the same way as well, and then we can start to train our platform to understand what indicators from that original survey data are leading to certain outcomes, once that mini-grid's developed.

And so hopefully kind of the work that we're doing today to standardize and get lots of data into a centralized platform will enable much more intelligent analytics about surveys in the future.

Sam Duby

I'll add a little something to that. This is Sam Duby here. I've done quite a lot of surveys in the field. I've had to deal with results of surveys. And they are notoriously unreliable, but there are ways to improve the learnings that can come from surveys. Sam Booth mentioned asking the right questions, but it's also important to triangulate it with other sources of information.

So for example, using satellite data. This is what the VIDA project I mentioned in our presentation is about. It's looking at, for example, a village, and the land use around the village. Do they have a lot of very fertile land around the village? That implies that they might be able to pay for services, so the energy demand might be high. Things like how close it is to a market, or how close it is to a road. All of these things are indicators that you can use to triangulate some of this information that is not necessarily coming directly from surveys.

Another key thing to add to on the ground efforts to gather information is observation. So you can ask people questions, and that is a key side of it, but it's also important for people on the ground to look at what is in the village.

So for example, looking at how many petrol generators are operational in a village. If in one village there is a lot of petrol generators, and in another identical village there aren't any, it would imply that there really is a market for energy that is being currently met by petrol generators, which tend to be relatively expensive, so that would imply that that would be a better site for a mini-grid, because the demand is already there.

So that's not something necessarily you get directly from questioning, but that's something you get from doing observation on the ground. So yes, the key point to add is that triangulation of different types of data.

Philip Voris

Thank you. And as a closing question, I'd like to ask each of our panelists in order, where next for the QAF? Let's start with Katrina.

Katrina Pielli

Well, I would _____ differ to the others on the phone. I think our job is really to help make sure that we're providing opportunities for NREL and Odyssey and TFE and others to implement this in the real world. And so I think our job is really to help make sure that people are aware of it, which thank you, everyone who's on the webinar with us today. But ultimately, we're keen to see where the market goes and make sure that the experts are out front. So I turn it over to my colleagues.

Sam Booth

So this is Sam Booth, and I guess I'll start with it's really exciting to see where we've gotten so far with the QAF, kind of coming from a framework document to maybe piloting on a single system or with a particular developer, to having people like TFE and Odyssey really take it and implement it in their platform, and implement a pilot program in Nigeria. So I'd say we're really at an exciting phase of the QAF, where it's starting to see more large scale implementation.

So from a performance monitoring perspective, I'd say what's next is to really prove it out in the pilot we were talking about in Nigeria—and take that

information and lessons and tweak it and help apply that to Africa and elsewhere in the world to kind of drive the high levels of standardization and business models that we've seen, and hopefully growth in systems and growth in deployment. And I think you heard kind of from all of us in the beginning, all of our end goals is really to see more systems built out in the field, and see quality systems built, and people being electrified.

So what's next is hopefully further progress on that journey, from a performance monitoring perspective. And I would say—and there's other challenges in the industry as a whole that we've kind of touched on around productive use and surveys and tariffs and other things, so there are other things that we'll be working on sort of in support of kind of advancing those efforts as well. But from the performance monitoring perspective, it's really piloting and rolling out at scale is what I see as next.

Sam Duby

Yeah, so I would totally agree with that. And to boil it down into four words, I'd say it's about—it's apply, listen, learn, and iterate. It's only through going through those cycles of actually applying it and seeing it offer value, seeing where the difficulties are, that it will ever evolve to being a decent system. So I would definitely heartily concur with what Sam has said.

Emily McAteer

Yeah, and I would just—I would echo the Sams. I think we're just getting started with this. Really looking forward to the feedback that we'll get from launching this pilot in Nigeria, and then using that feedback to both improve the Odyssey platform and to design it for applications in new countries.

Philip Voris

Thank you to all the panelists for that informative Q&A. On behalf of the Clean Energy Solutions Center, I'd like to extend a thank you to all of them, and to all of 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 would take back to your ministries, departments, and organizations.

We also invite you to inform your colleagues and those in your networks about Solutions Center resources and services, including no cost policy support through our ask an expert service. I invite you to check the Solutions Center website if you'd like to view the slides and listen to a recording of today's presentations, as well as previously held webinars. Additionally, you will find information on upcoming webinars and other training events. We are also now posting webinar recordings to the [Clean Energy Solutions Center YouTube channel](#). Please allow for about one week for the audio recording to be posted.

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