CLEAN ENERGY SOLUTIONS CENTER
ASSISTING COUNTRIES WITH CLEAN ENERGY POLICY

The Renewable Energy Data Explorer Tool: Private Sector Applications

—Transcript of a webinar offered by the Clean Energy Solutions Center on 27 July 2017—
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Webinar Panelists

Mark. Jacobson	National Renewable Energy Laboratory
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Stephanie	Hello everyone. I'm Stephanie Hernandez with the Clean Energy Solutions Center. Welcome to today's webinar which is hosted by the Solutions Center in partnership with the U.S. Agency for International Development, USAID, and the National Renewable Energy Laboratory. Today's webinar is focused on the private sector applications of the Renewable Energy Data Explorer.
	Before we begin, I'll quickly go over some of the webinar's features. For audio, you have two options; you may either listen through your computer of over the telephone. If you choose to listen through your computer, please, select the mic and speakers option in the audio pane. If you choose to dial in by phone, please, select the telephone option. A box on the right side will display the telephone number and audio PIN you should use to dial in. If anybody is having difficulties with the webinar, you can contact Go to Webinar's helpdesk at the number on the screen, 888-259-3826 for assistance.
	If you would like to ask a question during the webinar—and we really encourage that you do—please, type that into the question pane on the toolbar. If you're having difficulty viewing the materials through the webinar portal, you'll find PDF copies of the presentations at cleanenergysolutions.org/training. Also, an audio recording will be posted at the Solutions Center training page within a few days of the broadcast and will also be added to the Solutions Center You Tube channel where you will find other informative webinars as well as video interviews with thought leaders on clean energy policy topics.

One important note of mention before you begin 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. Today's webinar agenda is centered around the presentations from our guest panelist, Andrea Watson and Mark Jacobsen, who have joined us to offer a detailed look at how private sector developers and investors can use the Renewable Energy Data Explorer and gain greater understanding of renewable energy opportunities in various locations.

An introduction to the Renewable Energy Data Explorer was presented on a previous webinar and the recording is available online. You can find this presentation at cleanenergysolutions.org/training on the June 6th webinar. Before we begin the presentations, I will provide a brief overview of the Clean Energy Solutions Center and following the presentations, we will have a question and answer session where the panelists will address questions by the audience. At the end of the webinar, you will automatically be prompted to fill out a brief survey. 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, covering 90 percent of clean energy investment and 75 percent of global greenhouse gas emissions.

The webinar is provided by the Clean Energy Solutions Center which focuses on helping government and policy makers design and adopt policies and programs that support the deployment 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 co-sponsored by the governments of Australia, Sweden, and the United States with in-kind support from the government of Mexico.

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 to virtual webinar trainings on a variety of clean energy policy topics, partnership building and development agencies and regional and global organizations to deliver support, an online library containing over 5,500 clean energy policy related publications, tools, videos and other resources. A primary audience is made up of energy policy makers and analysts from government and technical 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 ECOWAS Center for Renewable Energy and Energy Efficiency.

A marquee feature that the Solutions Center provides is a no-cost expert policy assistance known as Ask an Expert. The Ask an Expert service matches policy makers with one of more than 60 global experts selected as authoritative leaders on specific clean energy finance and policy topics. For example, in the area of private sector engagement strategies, we are very pleased to have Christina Becker-Birck of Meister Consulting Group serving as one of our experts.

If you have a need for policy assistance in private sector engagement strategies or any other clean energy sector, we encourage you to use this valuable service. Again, the service is provided free of charge. If you have any questions for our experts, please submit it through our simple, online form that you can find at cleanenergysolutions.org/expert. We also invite you to spread the word about this service to those in your networks and organizations.

Before we begin the presentations, I'd like to provide brief introductions of today's panelists. Our first speaker is Andrea Watson. Andrea leads the Integrated Decision Support Group at the National Renewable Energy Lab. Her expertise lies in strategic planning, change strategies and decision-making support as applied to clean energy projects and programs.

Our second speaker today, following Andrea, is Mark Jacobsen, a senior project leader at NREL's National Wind Technology Center. Mark's work focuses on international assistance via renewable resource assessments and developing capacity building strategies, educational outreach for renewable energy technologies, primarily wind, and developing solutions for various market barriers of wind energy. With those introductions, I'd like to welcome Andrea to the webinar.

Andrea

Okay, thank you Stephanie. Hello, everyone. Again, my name's Andrea Watson, and as Stephanie mentioned, I'm a manager here at the National Renewable Energy Laboratory, which is a U.S. Department of Energy laboratory. One of my roles here at NREL is managing the portfolio of work that we do with USAID. So, before we get to Mark and some very specifics about how the Renewable Energy Data Explorer can enable developer investment in the renewable energy space, I'm going to give us a brief overview of what the Renewable Energy Data Explorer is and talk a little bit about the difference between the Renewable Energy Explorer and the Renewable Energy Data Explorer.

So, the Renewable Energy Explorer or RE Explorer is provided by a partnership between USAID and NREL. That partnership seeks to provide information and access to data for renewable energy decision making. The Renewable Energy Explorer can be found at RE-Explorer.org. When USAID and NREL partnered to develop this Web platform, we were looking at a number of needs that we believed that the RE Explorer is serving. The first one is recognizing that renewable energy resource data and supporting GIS

data sets are crucial to supporting decisions and helping local, state and national governments achieve their objectives in clean energy development.

We also recognize that decisions that are not data driven can lead to outcomes that don't reflect an appropriate amount of ambition, don't maximize cost effectiveness or are infeasible to implement. We hope that through education and access to data, we can make better goals and targets for nations and local governments. Thirdly, through the work that we do together with USAID, we've found that there is indeed a demand and a need for this type of information, for access to data, and for resources on how renewable energy data and the associated GIS data sets can be used to do analysis and inform that decision making.

We recognize that access to these renewable energy data sets and the associate GIS data sets that goes along with it can really help decisions makers and those that support them when they do clean energy target setting, when they make appropriate policy to enable countries working together with the private sector reaching those targets and how they manage, plan, and operate their power sector and how they work with the private sector just for investment in the clean energy space. Resources on all of this information and access to data can be found through the USAID NREL Renewable Energy Explorer. Once again, that's that RE-Explorer.org.

Also, on the RE Explorer, you can find our flagship tool, the RE Data Explorer. The RE Data Explorer is developed by the National Renewable Energy and it's an innovative Web-based analysis tool that uses geospatial and spatial temporal renewable energy data to visualize, execute, and support analysis of renewable energy potential under various user-defined scenarios.

So, RE Data Explorer is free to access. So, we encourage you to go to the site and start poking around. There, you'll find a tool that is quite user-friendly. Later in the presentation today, Mark will give you a demonstration of one way that that tool can be used. So, that's it for the introduction. Thanks so much for tuning in. With that, I will turn it over to Mark Jacobson, who will give you a little more insight on how the RE Explorer and the RE Data Explorer can be used by developers.

Mark   Thanks, Andrea. Appreciate everyone tuning in today. I really enjoy talking about energy development and specifically wind energy development. This certainly can be used for any renewable energy resource, but today, the example I'm going to use is going to be primarily wind. But it certainly can be used for solar or biomass, whatever data might be loaded into the tool.

Just a little bit more about myself then I'll quickly get off of talking about myself. But wanted to let you know that I did spend about 15 years developing energy projects. So, this development process is something that I've lived and breathed for quite a while. I thought it was important to actually talk about how this Renewable Energy Data Explorer tool could be used to support many aspects of the energy development process.

I thought, first, we would talk about the goals, then talk about the energy development process and then the application of the Data Explorer and I'll move over into the tool itself and walk you through how I would look at a specific project. Then we'll open it up for questions. So, it shouldn't be too much time out of your day this morning. Appreciate you joining us.

So, when people think about wind research, they often think of the physical. When they think about the National Renewable Energy Lab and the Wind Technology Center, they think about the big turbines that we have out there and the testing that goes on with turbines and blades and drive trains and gear boxes. Certainly, we do a lot of work in that area. The primary goals we're working with industry is to lower energy costs. That focus on that equipment has always been in the past to improve production, reduce installation costs, improve reliability.

This last bullet is kind of where we fit in here. We're finding that more and more there's a need to improve siting, decision making, siting tools that support decision making. The Renewable Energy Data Explorer is something that I wish that I would have had back ten years ago when I was first starting to develop wind projects. I'll get into a little bit of the history of what tools we had at the time a little bit later on in the presentation.

You've seen this slide before. Want to make sure you know where to access the tool.

I think that as we kind of look through what we want to learn today, it's important to understand how valuable a graphical representation, an accurate graphical representation is in providing information to decision makers. It's also important to make sure that you have an improved access to the data. I'll talk about how difficult that was in the past and how the tool improves that aspect of information gathering.

With more information, faster information, more accurate information, you're going to reduce prospecting time. That's important. Of course, if you can't use a new software package or tool then it's not going to get used and you're not going to be able to access the benefits. So, I think through the demo you'll see how easy it is to use and to manage and evaluate multiple layers of information to support decisions.

When we talk about the wind development process, being an old farm boy myself, I love to use this description of the old three-legged milking stool. If you're not comfortable or not familiar with all three of these legs of development—market, the wind resource, and the land—the stool tips over and you don't have a project. So, we're going to talk a little bit about all three of these in a little bit more detail.

So, when you're looking at the market, of course you're got to start with customers. You've got to understand what the future energy needs are. You want to understand in the region where you're looking to develop a project with a wholesale energy prices are. How competitive might your renewable

resource be relative to the existing wholesale power prices? Of course, you want to understand what the policy drivers are in the region.

I'm using a U.S. example here of an RPS—that stands for renewable portfolio standard—and that's a mandate for a particular region, whether it be a state or a province, to buy a certain percentage of their power from renewable resources. That certainly increases the appetite to buy wind or solar when you have an RPS. It's important to know that when you go into a new region.

Of course, interconnection and transmission availability. A lot of individuals will use these two terms interchangeably and they shouldn't. The interconnection process is a separate and distinct process from the transmission process and then you're trying to understand about availability, you have to go through a separate study process with each. I've identified throughout the next few slides certain topics in gold font and that's to let you know as the viewer that we believe that the ready tool can support these aspects of development. So, on interconnection and transmission leg of the stool, it's important to know where those transmission lines are, what size we're talking about and, later on, I think that there will be additional information that can be loaded in the tool that might even talk about ownership of those lines. Currently, it focuses more on size than kilovolts.

Looking at the next leg of the stool, the objective, right off the bat, is to focus on a way to get information that allows you to generate in that capacity factor right off the bat. You're going to be—for those of you that are not familiar with net capacity factor, that's a term that wind folks use to arrive at an annual production number. You want to get a feel for that as soon as possible so that you can put some preliminary pricing together and see whether you are going to compete in that marketplace. So, how do you go about getting that information? Well, you try to find it publicly online. You might purchase a wind map. You might even, if you're looking at a bigger region, develop or purchase a model of the wind resource for that area.

Then later—and you'll eventually have to do this—you'll have to measure the actual wind resource at that site. So, you'll have to install meteorological towers and validate any past models that you might have been working with. All of this, I might add, is about reducing risk. So, when you're looking at a development project, you might start off with a certain amount of information that is an overview of a project's profile but you're continuing trying to grab and obtain more and more information to reduce the risk of the project so it can improve your chance of financing the project or improve the financing terms once you get to that point.

The next leg of the stool, and the last leg as I've thrown out these three examples of market, wind resource, and then the last being land, it's important to understand what the land profile is. What are the land resources? Who owns the land? Why is this important? Well, if some of the land is private and another area might be federal, that could change your timeline on permitting. Transaction costs are different. It would be easier, typically easier, to secure leases with private land owners than it is with the federal agency. The permitting timelines, as I mentioned, are longer with a federal land

acquisition as opposed to private. So, that's important to know as you're comparing project sites.

Also, understanding, again, back to focusing on the land use, it's important to know are you close to an urban area. Is there an environmental concern, a protected area that you need to be concerned about? Again, you're looking at probably, when you jump into a new area, you're looking at eight, nine, ten sites. You're trying to rank which ones do you think have a stronger wind resource that will be able to compete in the area and which ones do you think you'll have a better opportunity to get permitted and financed and actually built. So, you're looking at all of these aspects to help get to that final decision of what site are you going to move forward with and spend more capital developing.

Talked a little bit about land leasing already. On the permit side—again, this is all under the third leg of the stool, land. Obtaining permits—that can be a very high transactional cost activity. That's why you want to really understand that you've got a good site moving forward before you spend that time and money. You'll frequently have to do a noise or sound study, a flicker study.

There are numerous wildlife studies that typically are done depending on where you're locating your project. Sometimes we're required to do one to two years' pre-construction avian studies and one to two years of post-construction avian studies. There might be some archaeological issues on the site or near the site that you have to be aware of. So, working with the Historical Preservation Department of Division within your project site's area is important.

Then, of course, understanding and making some estimated calculations on what the job benefits are and tax revenue might be for the community is important to balance out the impacts. There's also, obviously, environmental benefits that you want to be able to promote for your project. As you're looking at the ready tool—again, we'll jump into it pretty soon here and demo it—I think a lot of the information that is there can be used for developing a presentation. It can be even used in your application when going through these various permitting processes. Again, it is processes. It will just often be a permitting process with the federal government, with state, and local. You have to be aware of all those entities that you have to—and their criteria to get a project permitted so that you can move forward with financing and construction.

So, we just hit on from a big-picture perspective. Certainly, we could have dived in more detail within all three of these legs of the development stool; the market, the wind resource, and the land. But what the important takeaway here is that the Renewable Energy Data Explorer assists in all three of these legs. Not only were we able to identify transmission lines and the size of those transmission lines but we're also able to identify where the strongest wind resource is. What I think is very interesting and important is that not only are you visually looking at it, but with the Renewable Energy Data Explorer you're able to actually download that data. We'll talk about why that's important in the couple slides from now.

With the land leg, certainly we're able to fine-tune and help microsite our project before we buy plane tickets and spend a lot of money to go look at an individual site. We'll know what the land uses are, is it wooded, is it a field, is it ag land or is it urban land. Is there a protected environmental area? All this information can be accessed via this tool.

So, obviously, we just talked through these three steps, but the three steps that we just discussed are not the only steps in development. This kind of looks at the—in one slide, with big-picture buckets where we've been and where we're going in the development of a wind project. Certainly, in the orange, again, the gold is identifying the steps and development that the ready tool can help support. Helps us select a site. We're able to access the renewable energy data and actually download it for our purposes.

Typically, that first purpose is entering the data into a production model. Some of the models out there are Open Wind, Windographer, Wind Farmer. Basically, that is a model that the wind data gets inserted into and allows you to look at your project and the number of turbines that you have, the type of turbine you have with its own specific power curve and play around with the layout that will give you an annual energy production number. Then with that number, of course, that gets inserted into a very proprietary, usually very company specific pricing proforma. You'll put together a preliminary proforma that will kick out a bid price and give you a feel for whether you compete in that marketplace or not.

As you take this line up into the right side of the slide, then these are kind of the big bucket, final development steps. Certainly, your project should be maturing as you're moving forward. You're continuing to reduce risk as you're getting more and more information. You're getting your permits. You're getting your measured wind data from that site and you're able to market to the power buyers, negotiate a contract, obtain financing with this information and then construct and build the project.

I think as—just before we move into the Renewable Energy Data Explorer itself, I think it's important to know where we've come from and where we're going. The State of Indiana I think gives a perfect example of past tools that we have used. This is a state that is in the Midwest, the center part of the United States, just underneath the Great Lakes for those that might not be familiar with the individual states in the United States. On the left side, you're looking at just a simple PDF map that was out there in the industry that wind developers and investors looked at, had access to, and then turned away and said, "Not interested."

Basically, it was a map that was a wind model at 50 meters. I know that there are a lot of those kind of maps that are out there for different countries. You just didn't see very much development there. The takeaway here is that you need to have better information that matched up with the technology as it was improving. So, certainly, it was recognized that 50 meters was behind the times. Hub heights had moved to 80 meters and higher. Models were getting better. They were validating these models with actual data.

So, Indiana, for this example, had like nine or ten tall towers distributed geographically across the state and took actual measured data, validated a model. The product that you see on the right showed that there was a wind resource in many areas. All of a sudden, 1,500 megawatts was built. I'm not saying that this exact wind map was the only reason that spurred—investment was spurred on to install 1,500 megawatts, but I think it was a prime driver, because the visualness of the wind resource is something that graphical representation of the strength of that wind resource is one of the first things that wind developers do look at and I think this was a prime driver to the 1,500 megawatts that were installed.

So, that's where we've been. That's was a key step change as we were moving forward to try to provide more information to industry to locate and site projects in various areas. Then where we are right now is this next step change. This is what's exciting. I think having—moving from a PDF map, a static map, to an actual data product where there are many layers that you, as the user, can easily maneuver and customize a view that would help you in decision making is extremely important and extremely valuable. With that, I'm going to move into the demonstration, if I can do that in a smooth way. Here we go.

So, as you might have noticed from the overview map, there are a number of countries where we've pulled together the data layers necessary to develop this tool. We don't have it for every single country in the world, but I tell you, as each year goes by, we're adding more and more countries to this tool. So, you'll start off with a basic map. I'm going to show Pakistan here for a few moments. You look on the left-hand side. We have three major tabs: the data layers themselves, the legend of the layers that you actually end up clicking on, and then a query tool. I'll talk about all three of these.

So, if I click on the wind speed map itself, and then hit—as I look at this from, again, a developer's viewpoint, the first couple of things I want to look at—I'm going to put them in order or just how I think through it. I'm going to look at the wind resource and then I'm going to look at both substations and transmission lines. I'm going to move into the tool. I've got my—I'm going to zoom in to an area. One more touch on the zoom. That's good enough.

Again, to orient you with regards to our color scheme, you'll see that the legend shows that yellow to red is an increasingly strong wind speed. These are annual wind speed numbers. The blue numbers—we have basically a two-color scheme legend here where blue indicates—and different shades of blue—indicates six meters per second and lower. Six meters per second and higher is the yellow to red color scheme.

So, I'm going to look in here and see that there is a strong wind resource here in the southern region of the country. I'll be able to click on—each one of these pixels I think is two kilometers by two kilometers. I'll be able to look at where, basically, transmission overlaps a strong wind resource. That's the first thing that I'm looking at. So, I'm looking at a region down here that seems pretty hot with multiple transmission lines.

One of the things that is also interesting here with the transmission line layer, is that the—oops—I actually have black and green, black meaning an existing line; green meaning a proposed line. That's very interesting for a developer to understand exactly where there might be new transmission in the future which would tell me maybe any project that I develop now will have the ability to expand later because there's going to be more transmission in the area. So, that's kind of another important aspect.

So, now I'm clicking on a line here. You can see that I've given a drop box that allows me to click on information on this line. This is important. So, now I have a voltage of 500 KV for this line. That might tell me that that's not a good line to interconnect with because if I'm looking at a project that's 50 megawatts or smaller, I probably don't want a very expensive substation to interconnect to.

I'm probably looking at voltages that are 230 or lower. So, I'm going to maybe click to a different—what's my goal? I'm trying to get close to identifying what a potential project site might look like and if this is a good one or not. So, now I'm looking at this line and I've got a transmission line that's saying it's between 66 and 132 KV. So, that might be a 40 megawatt to 100 megawatt-size site. If that's the goal I have, then I'm in a decent area. I can also click on the wind speed.

This is what's different than looking at a PDF map. I'm able to click on wind and, basically, identify what the wind speed is and the specific GPS coordinates. I'm also able to download that data. I'll show you how I would do that. This is just giving me basic visual information on the transmission line and the wind resource. So, now, if I want to actually capture that data, I'm able to draw a small, little box, a little query. You see on the right-hand side, I have a download button. I can open this into an Excel spreadsheet. Now that data is mine. Very valuable tool. I can put that into any other kind of evaluation software package that I have. I'm going to close that.

Now, kind of moving on, what are the other filters that I'm looking at if I'm trying to develop a wind site? I've immediately kind of moved myself down the path of saying I got a strong wind resource, I've got transmission lines that look like they would support either small projects or large projects. There is also future transmission in the area. So, I could potentially expand this project if there's a need to and there's an appetite by buyers to buy additional wind. Now I'm looking at the—that's that market leg of the stool, right, that we talked about, and the wind resource leg of the stool.

Now, looking at the land, specifically, as I zoom in, we look at other layers. You'll see that I have a land use option. Now it's always important to understand with a GIS-based tool is that you're putting one layer on top of another and that can get muddy and unusable unless you just remember that that's happening. So, you'll have to go back to the legend and either turn off or reduce the opacity of the wind resource layer that has a lot of colors to it.

Now I can look at land use. Understanding what the individual colors mean, what do you think I'm looking for? I'm certainly, probably not wanting to

have a project that's located in an urban area. So, pink would identify that. So, it looks like my area that I was originally looking at is not a city. So, that's important.

It's telling me whether I have—whether this land is crop land, whether it's grass land, whether it's wooded. All of these are important pieces of information as I'm kind of starting to narrow down with what I think that project site might look like. Again, I'm probably doing this for ten different sites across the country. I'm going to start ranking them based on the profile for, one, the wind resource and then, two, the land use info; do I think there's going to be any permitting issues.

If I go down to the next layer, administrative—trying to get that to move. Excuse me. Just having trouble with my screen moving. I know how to do this. Just sorry for the silence here. But I can identify county boundaries, state boundaries, and cities. I just wanted to call attention to that.

Here is another one that I wanted to click on and that is protected areas. Usually, you're not going to want to locate your project in a protected area. So, as you can see here, as I turn the protected area off and then on, these are probably wildlife areas, other environmentally sensitive areas. I want to make sure that my project stays away from—is strategically located at a distance from these layers. I'd always want to talk to these agencies to know if there's specific setbacks from these areas. So, maybe looking at a project inside the boundary is not the only concern. Maybe I need to be ten miles away from that area to be able to get the permits pulled to actually build the project. So, anyway, additionally, good information.

In the old days, it might take weeks or months to try to pull all this information together, actually travel to these environmental agencies and develop a relationship with somebody to pull a map and you're creating your own maps and sometimes they're not as accurate. Sometimes the information is not fresh. It just would have taken a long time. Here, with this tool, it's all kind of a one-stop-shop.

So, I think I've walked through, in a fairly quick manner, the steps that would be looked at by a developer and the key topic areas that would be—data layers that would be used in the tool to start to microsite a project. Again, I think that this is an area, at first glance, just within this webinar to say, "Hey, there might be some possibilities here." Eventually, you're going to have to have boots on the grounds to go look at a site, go talk to the permitting agency and decide whether this site still stays on your list of not.

I'm going to move back to—oh, there's one other thing I wanted to share. So, that was Pakistan. This data from the wind resource leg, this was data that was from a model. With Bangladesh, again, we're just adding more and more information with each ready tool that we have. As you see here, this is a wind map of Bangladesh which has the little anemometer icons on it. This is a project that we're partnering with USAID on as well, where we're actually collecting in nine meteorological stations measure data over a two-year period, a two-year measurement campaign which is going to be used to

validate a model. We haven't validated that model yet, so we're kind of still in the middle of the project.

But if you've clicked on these icons, you'll see a meteorological station will pop up and you'll get a download link for the actual raw data. So, you'll have two data sets that you can look at as an investor. One would be the validated model data that we're going to have this spring for individuals to look at for Bangladesh, but if you wanted the actual data from—the actual measure data from that website, you'll also have the ability to access it from the ready tool. I think that that's just extremely valuable.

So, with that, I'm going to move back to the presentation. I'm just going to touch on this a little bit. There's multiple user groups for the Renewable Energy Data Explorer. I'm focusing this presentation on the developer, but certainly policy makers use this as well. Frequently, I have found that in the 15 years I was developing projects that I was also—I was often working with the policy maker to answer some of these questions and get information pulled together to help develop a market or a—helped answer zoning questions for a government agency, whether that might be a local level or maybe an RPS, a target renewable goal at the state level and, in some cases, they're just policy at the federal level and we'd work together to resolve the questions that were out there.

Some of those questions were, "What's the quantity of the resource in my area? Is it something I—is of high enough quality that I should be spending time on developing policy for incentivizing renewable investment? What's the economic development potential?" Those two bullets are kind of related, right?

If you have a strong resource, then there's probably going to be a strong economic development opportunity. What kind of incentives have worked in other areas? That's something that policy makers, government officials are frequently asking. What's worked in other areas that you might be investing dollars in and would that be right for my region, my country? Again, understanding, getting a little bit more granular, what's the location of that resource?

Why is that important? Well, it might be special zoning requirements that they might want to have in one area versus another. They might want to balance the environmental issues with the clean energy roles in their country. There might be an establishment of a renewable energy zone that they're interested in where they're incentivizing that development in a particular area that's not going to be butting up against urban development.

Then sometimes government agencies are actually the same entity that owns the transmission lines. So, working with them on all these other bullets that we just talked about as well as understanding where future transmission routing might be located through a strong, renewable energy resource is also important. So, I found myself sitting across the table from a number of policy makers working together to solve some of these problems or answer some of these questions.

So, what have we learned? I hope that you have learned that there's—that the tool provides improved access to data, that the graphical representation of that data is superior to past methods that we've used in developing information for energy siting purposes, that it was easy to use. Frankly, my two sons seem to know how to use my phone and computer better than I do, but I'm able to use this tool without actually going through the tutorial. It's very hands-on, very easy to walk through. When you're able to work with a tool easily, that certainly makes you more efficient and improves your prospecting process. When you're saving time, you're saving money.

What's our ultimate goal? We're always trying to focus on the results, of course. What we're trying to do is spur investment in your region, your country. That means more jobs. That means more tax revenue. That means more cleaner, renewable power. Of course, it means generating low-cost energy. With that, I'll be glad to take any questions that might be on the line.

Stephanie
Wonderful. Thank you so much for those presentations. We have a few questions that have come in. The first one is regarding collecting data for the RE Data Explorer. What sources do you use to gather this data? A specific question has come in. Do you accept partners with other utility companies in those countries to work on keeping the data up to date and populated? Could you explain a little about that?

Mark
Yeah, so typically, the data is created via a model. There's a—it really depends on resources, right? That's always the answer. There's a lot of data sets out there that can be used to create a model and those models are getting more and more accurate each year. A basic layer—wind resource layer, solar layer—can be provided via a model. Where you can—if you had additional resources, what we're finding is the best way to create that data layer is to start with that model and then actually get measurement data multiple years and validate the model with actual measured data. That makes the necessary adjustments. Then that data layer is even more accurate.

So, that's typically how those models are generated. Absolutely, we're looking to partner with any partner that is interested in increasing the performance and the capabilities of this tool by adding additional layers that you might have working with utilities that might have an updated transmission map or a future transmission map is good. If there's additional dollars that they want to use to contribute and partner with USAID and NREL to update a wind resource model or to add another renewable energy data layer, we're absolutely interested in talking through those opportunities. So, feel free to email myself or Andrea. Our email addresses are on this presentation. Be glad to chat with you further on that.

Stephanie
Great. Just a reminder; those presentations will be available at cleanenergysolutions.org/training. So, you'll be able to get the contact information there. Our next question is on is there any intent to add market data to the explorer or is it already present in the model as it is now.

Mark
So, if you mean market data—if you mean estimates on the price of power—because I think that could be answered a couple of different ways. I'll answer

it assuming that that's what the questioner is referring to. Yes, we have a layer that, based on the inputs that we can obtain from our state partners and other stakeholders, we have a layer that's called an LCOE layer, Levelized Cost of Energy. That's an interesting layer to look at.

My only but on that is it's all based on the accuracy of the inputs and sometimes that's difficult obtain. But we are working with each country to see if we can't add an LCOE layer. That's very specific, of course, to the equipment that you're choosing, the power curve of the turbine that you might be using which effects, of course, production and cost. It can be unique to— the insulation costs can be unique to the area that you're developing a site in.

If it's close to mountainous, the installation costs might be higher than one that's in the plains. So, when you look at a big, broad based model like this to show LCOE costs, sometimes you don't capture some of those customized features of a specific project site. But I think that that can be a very valuable layer, as long as you understand its limitations.

Stephanie   Great. For the next question, "The RE Data Explorer is only in a few select countries right now. Do you know what countries are next on the list to get the full range of information?" Andrea, would you want to take that one?

Andrea   Sure. Even with the existing countries, you'll notice there's some variability that's in the tool. One of the ways that you can understand what data's in the tool is when you're in the tool itself, on the left-hand side. Mark spent a lot of time clicking on and off the data layers. To the right of most data layers is a question mark. If you click on that question mark, you'll see the metadata.

The metadata talks about where we got that data, what sources, who we partnered with, whether that's model data or ground-validated data. So, in that sense, you can kind of see what stage of development various tools are in. Some of our most advanced tools are the ones that Mark showed like Bangladesh, Pakistan, India. So, the other tools on there like Indonesia are tools that we're looking to continue to increase the quality of the data in the tool and with Kazakhstan. So, right now, we are considering what countries to expand into. We'll do that collaboratively with USAID. So, right now, we're focused on the tools and improving the tools that are available today.

Stephanie   Great. So, for the next question, Mark, can you give a little bit more information on what is the resolution of these maps?

Mark   They can be different from country to country, but typically we're seeing two-kilometer resolution to five-kilometer resolution, depending on the country. That two to three range seems to be a standard for a lot of the modeling that we're doing right now. Again, that answer actually is two-part. If you were able to get the actual modeled data, which we are going to make available, that resolution is going to be higher than sometimes is on the computer screen.

Stephanie	Okay, great. Just a question for Andrea. For the basic purpose of the RE Data Explorer, is it primarily to provide info for policy decisions or actual renewable energy projects or both?
Andrea	Yeah, I think today we focused largely—Mark focused on the way a developer uses this tool, but the idea is that there's a much broader set of users. He touched a little bit on how policy makers might collaborate with developers to use this tool. But absolutely, policy makers are another potential audience of this tool. Policymakers, and we like to say, and those that support them in decision making. So, folks like at universities or analytical arms of the government might use these tools to help inform decision making.

Especially if you get into some more complex policy making, you may end up doing more complex analysis that might be more appropriate for a technical institution within the country. But indeed, we feel that—well we know that using high-quality data, doing analysis on that data to drive decision making in the policy sense can really lead to smart policy. So, anything from setting appropriately ambitious targets for clean energy in the country, such that countries are sitting targets so they can both realistically achieve but also set an appropriate amount of ambition for how much clean energy they can see within a given amount of time in their electricity sector. Other policies might be compensation for clean energy within a country or designing a competition procurement process.

All of these are policies that the Renewable Energy Data Explorer can help inform. Certainly, not the only thing that's going to be taken into consideration, but can help inform that. There's a couple other user groups that I think are important. In addition to developers, there's the investment community. Having a third party, neutral set of data that can really validate the results that developers are showing in a project can help achieve financing more easily and garner a sort of trust that, yes, the data being used is from a validated source or at least a source that's transparent, that's third party to the development community. That can help financiers make those types of decisions.

Then also, I think an audience that's important to mention is the sort of grid operator, grid planner audience that really has a lot of questions on where renewable energy development is likely to occur relative to the existing transmission and distribution system. Then, unfortunately, it's not something we touched on in depth in this webinar and has been topics of webinars in the past and will be in the future is sort of how you plan and construct new transmission to most cost effectively access variable, renewable energy. One approach to that that we talk about a lot here at NREL is a renewable energy zone process. There are precious Clean Energy Solutions Center webinars on that topic. But it's definitely something that you can start to stand up that renewable energy zone process with a tool like the Renewable Energy Data Explorer.

Stephanie	Wonderful. One final question before we wrap up here is, "How do you address the need for public or private sector users in the tool in their local language such as Vietnamese?" Is there a –
Andrea	Yeah, I think that's something that we could stand to improve on. We're working closely with, obviously, a number of countries that have—with a number of different languages. That's a great opportunity for partnership. Already on every single one of these tools, as Mark alluded to, we have local partnerships. There's no way we can access that demographic data, the land use data, the protection data without local partnerships.

It's definitely within our capability to visualize different languages on the tool, to create user guides in different languages, to create tutorials in different languages. Sort of on a long list of development improvements that we can make, but I think with local partners that are really demanding bilingual interfaces, would lead us to do that a lot faster. Definitely a capability we can do. |
| Stephanie | Great. Thank you so much. With that, we will wrap up here. On behalf of the Clean Energy Solutions Center, I'd like to extend a thank you to our expert panelists and the attendees for participating in today's webinar. If you have any additional questions you would like to submit, please do so in the question pane and we can connect you offline.

We invite you to inform your colleagues and those in your networks and organizations about the Solutions Center, resources and services, including the no-cost policy support through the Ask an Expert service. I invite you to check the Solutions Center website if you would like to view the slide and listen to a recording of today's presentation as well as any previously held webinars. Additionally, you'll find information on upcoming webinars and other training events. We are posting the recordings to the Clean Energy Solutions Center You Tube channel. Please allow about one week for the audio recording to be posted.

Finally, I would like to kindly ask you to please take a moment to complete a short survey that will appear when we conclude the webinar. Now everyone, 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. |