DISTRIBUTED WIND SITE ANALYSIS TOOL

January 5, 2012

Coordinator: Welcome and thank you for standing by. At this time all participants are in a listen only mode. After the presentation there will be a question and answer session. To ask a question at that time you may press star 1 on your touchtone phone and record your name at the prompt. This conference is being recorded. If you have any objections, you may disconnect at this time.

I would now like to turn the call over to Ms. Karin Sinclair. Go ahead ma'am. You may begin.

Karin Sinclair: Okay. I want to welcome everybody to the first Webinar for the ASES Small Wind Division for 2012. We actually have this series of Webinars every other month. And just very briefly I will tell the topics that we have set up for 2012.

In March the topic is Small Wind Turbine Certification and Testing. May we'll talk about - we'll hear a report on the Interstate Turbine Advisory Council. In July we'll hear some results from research that's looked at the difference between predicted and measured wind speeds at distributed turbine sites.

(Duwee) will provide us with an update on their activities in September. And in November I will talk about some work that I'm doing regarding the NABCEP's installer certification program and some difficulties that they've been having.

I would also suggest that if anybody has another topic they're really interested in hearing that they send out those topics to me. These Webinars are the first Thursday of every other month on same time 12:30 to 2:00 with the exception

of July because of the holiday. We'll probably move that to July 12. And notices will be sent out about these Webinars.

So I'm excited today to have Shawn Shaw talk to us about the distributed wind site analysis tool. Some of you may have heard his presentation last year. Shawn's from the Cadmus Group and he's been working on renewable energy for at least ten years and he's worked extensively on distributed wind energy projects and programs in the Northeastern U.S.

He's been focused on performance monitoring, funding program design evaluation, site assessment and the development of tools and resources to help improve the accuracy of pre-installation (of) energy yield predictions.

So today, as I mentioned, he's going to talk to us about DSAT, which is a tool that's been developed primarily with funding from the Department of Energy. And really excited to see how this works so take it away Shawn.

Shawn Shaw: Great. Thanks. I'm very excited to be here and I want to say thanks again to ASES for putting on the series of Webinars and for letting me participate in this one.

So as you've all heard, we're going to talk about DSAT today and I sure wish I could have come up with a really snappy acronym but that was the best we could do being busy making the tool work and all.

So bear with me. We're going to talk a little bit about where things stand with performance prediction. I don't plan on rehashing what I talked about last year but there are a couple of things I just want to kind of remind us of and discuss why we need something like DSAT in the first place. And then talk about what DSAT really is, kind of how it came to be, what it does, how it does it.

You know, we're going to look at some of the sources of data and where they, you know, where they came from and how they're used. We're going to talk about how DSAT performs against other tools, how it performs against reality most importantly and, you know, sort of talk about where things might be going in the future for DSAT. What's next?

If there's time I also hope that we can walk through actually creating a site with the tool and looking at it. But we'll see how many questions and such we run into. Let's see. Oh. Ah. Sorry.

Just a quick word of introduction and acknowledgement to the development team. This was funded by the U.S. Department of Energy under the 20% by 2030 Wind Powering America grants. And Cadmus was the lead development firm on this with a lot of strong support from our partners at NREL and (NCRAFT). And of course, you know, we like to thank DOE for its support and funding for the project.

So DSAT is kind of in this intersection place that I see as really critical to helping people site distributed wind turbines and having the industry be successful. People need something that is fast, accurate and inexpensive. The margins on most small and distributed wind projects are very small. They don't account - they don't have money in those budgets for Met towers or big fancy studies or expensive reports.

You just need a number. You need a quick lease so you can get it to your customer so you can get your rebate applications filed. You can get it to the permitting bodies if necessary. And it's got to be right because no favors are done to anybody in the industry by putting out overly optimistic numbers that upon any sort of examination at all are shown to be unrealistic.

You may sell a bunch of turbines in year one and maybe in year two but in year five when people start to catch on, the market is going to plummet. It's happened. It's happened at the state level. Here in the Northeast we've seen it happen. It's happened elsewhere.

So all three of these things I think are sort of equally important. You know, equally important sides of the triangle, if you will. And that's kind of the basis that DSAT is founded on is trying to pull together all three of these key elements and make something available to the industry that meets that need.

Site assessment is challenging. You know, like I said, I'm not going to rehash everything I said last time. But we all know that accurately determining how much energy a wind turbine is going to produce before it's been put up is tough. You've got complex terrain. You've got obstructions.

The wind resource maps aren't always what we would hope they are or at least if they are, we don't necessarily have the right information to interpret and use them correctly. And we may not have a good sense of what the real world operational characteristics are going to be.

Even, you know, especially with so many new turbines on the marketplace, this is really tough. How does, you know, how do turbines respond to gusts? How do turbines respond from rapid changes in wind direction? That's all very hard to know ahead of time.

And historically using sort of basic free tools our ability to predict how a wind turbine is going to perform has not been all that stellar. Many state programs have thrown money into small wind programs and been to varying degrees disappointed by the actual results when they evaluate their program. Not

necessarily because the wind turbines aren't working but because people didn't have realistic expectations on the front end of the project.

And that impacts the decisions people make on whether to move forward or not. You may be willing to live with a project that produces 8000 kilowatt hours a year but if you then are using a modeling tool that tells you some that's twice what reality is, chances are you're not also willing to put in that system if it's only 4000 kilowatt hours a year. So these are the kinds of things that the industry faces as a challenge.

So DSAT addresses this in a couple of ways. We wanted to have something out there that was free and available for people to use to determine whether or not wind was viable at their home or small business. We wanted them to be able to figure out how much energy they could save and all of this.

So we set the setup. It has the standard account. If you do nothing but start an account and set it up, it's free and free for life. You can put in up to three sites and model them. You can generate the basic performance report that tells you kilowatt-hours per year and such. That's all fine.

For the more professional users, we do have a - sort of a professional account that has additional features and offers a lot of additional information. That's more geared toward the people who are actually selling and installing wind turbines so that they have everything they need to put together a fairly comprehensive report that can just be handed off to customers and such.

So these are the sort of the two ways to access DSAT as the standard user or as a professional user. Now I'll be getting into more detail on what some of these different features and such are as we go along. And there's a really a variety of intended audiences for a tool like this.

You know, everything from - you know, like I said, the interested land owner who has a farm or has a plot of land somewhere and they're thinking they'd like to do a wind turbine, DSAT is great for that. You just go in, you model your site and it tells you how much energy you can generate.

You can turn around and hand that number off, excuse me, to a grant-making agency as part of an application. You can use it, you know, to help you find a project installer to quote on the job. Very handy stuff.

Communities, installers, developers, clean energy funds; it's also a great tool for them because there's a lot of information captured here. A community for example can use it for this in the same way that the land owner would with the added benefit that as far as - as far as we go, you know, we're there - we're available on the backend of the tool to work with communities and help them site the project and get the most out of what they're doing.

So there's a lot of diverse audiences that DSAT is well suited for. Like for example with clean energy funds and utilities, we can compile all of the projects that are being proposed and track them centrally and provide reporting and all kinds of things.

So it's a very powerful and flexible tool that does a lot of things with the information it collects and the calculations it makes beyond just giving you a report about your site. You can look at all things sliced and diced in all kinds of ways. But enough about that.

In terms of how DSAT actually works, there's three basic building blocks. The first is the wind resource data, which pulls in things like your wind speeds, your wind rows, you know, so you know which directions it's coming from.

Your (liable) distribution which is just the shape of the probability you have telling you how many hours a year you'll get of wind speeds at five, six, seven, eight meters per second, whatever the speed may be.

We combine that with information about the site. Now some of this comes form the tool itself and some of that comes from the user. You know, the tool know what the elevation surrounding the site are but it may not know how you want to classify your terrain or what obstructions you want to add to the site.

And then finally the system configuration; there's a mix here as well. We have 26 turbines in DSAT's library right now that you can pick from. You can - there's a variety of different types of mounting configurations and hub heights you can include. All of that goes together and helps calculate the annual energy output, the visual impact and the environmental benefits of the system.

As a starting place, we decided early on based on the cost of alternative data and upon a premise of DSAT which is basically that you can use the computer modeled mesoscale wind maps to accurately predict performance if -- and this is a big if -- if you can accurately reflect your site conditions in the model.

And that's really been kind of a think a falling down point in the past because a lot of folks will point to the wind maps and say well, they're just too inaccurate. We can't possibly do anything with that. And I would push back on that a little bit and say a mesoscale model isn't perfect but if you know what your - how to explain your site to your model, you can still get good results from even in this case 2003 data that was validated by NREL.

On a state-by-state level high resolution grid there's a lot of data in there. I don't know how many terabytes we filled up compiling all of it but it's a lot. And so we've got wind speed distributions, wind roses, wind speeds at

multiple heights, a lot of wind resource data is behind - in the back - in the back part of DSAP behind the scenes.

So about that micro-siting, there's a couple of things to bear in mind. The way we treat the sites is we split them up into 16 directional segments. And by and large we treat those directional segments independently, which means you can define - for each segment you can define a different terrain type as fits you site.

So you can have for example forested terrain in one sector and the next sector if there's a clearing there you might choose to reflect that as grassland or cropland or something else.

And at the end of it what we end - what we do in the end is all of the data from each of the segments gets summed. So you're effectively running 16 different site assessments simultaneously. And we've had good results with that. We used that approach first with some of our earlier work specifically in Massachusetts with the (Quest) tool and things like that and it's worked very well there. And we kept that general approach to terrains for DSAT.

Once you've defined your terrain what that tells the tool is it tells the tool something about what wind sheer will be in that direction, what the solidity of you terrain will be which you can change. But for example, a dense forest will be more solid than a sparse forest, which means that you're going to stop more of the wind below the canopy in a denser forest than you are in a sparser forest.

That's fairly intuitive but important when you're trying to figure out how to adjust the general wind speed from that direction. Because what you need to apply is you need to apply something called effective ground level.

Just really quick for those who may not know, what happens is like I've shown in this diagram when you have the wind approaching an open terrain and it encounters a solid mass or relative solid mass like a dense forest or a block of buildings, the wind can't go through it. So the wind decides to go over it.

But as the wind goes over it, the wind speed is reduced because if you're looking - if from a turbine's perspective the wind is no longer at 100 feet in the air. The wind is now at something lower because there's something in the way. That's what effective ground level is essentially accounting for and we adjust the wind map's wind speeds to the hub height of the turbine using that principle.

Obstructions are kind of a - kind of a similar saying but they're - basically the difference between an obstruction and a terrain is the obstruction may not take up all of a sector. You know, you may have a tree in the North Northeast but it's not a forest. It doesn't take up the whole of the North Northeastern section from you turbine's perspective. It only takes up a small amount.

You may also have a situation where essentially what it is is an obstruction doesn't really change you wind sheer profile very much. It doesn't move the overall level of your wind. There's no effective ground level associated with it.

What it's really doing is it's taking the incoming wind and it's creating a wake, just sort of a downstream low-pressure high turbulence region behind the obstruction out for some distance.

For example, what we've shown in this graph here in the upper right in the slide is what the relative wind speed is and that means that what is the wind

speed measured with the obstruction versus the wind speed measured without the obstruction for I think this is a deciduous tree.

So what you see is is that about 3H above the tree, so a 30 foot tree 90 feet in the air you don't see very much wake from that tree. However, at something lower than that say at 30 feet, which corresponds to the red line on this graph, the closer in your are to the back end of that obstruction, the lower the wind speeds are.

So here we are even at 10H downwind. So 300 feet downwind of a 30-foot tree your wind speed still hasn't returned to what it would be if that tree wasn't there at all.

So DSAT accounts for this across I think 27 different obstruction types. So different types of buildings, different types of trees, some sharp terrain features are included. A lot of this - a lot of this - the effort in building DSAT came about in terms of developing these wake affects.

We also deal with mounting affects. I think it's safe to say there aren't too many tools out there that attempt to address what happens when you put a wind turbine on a building. That's - as it turns out that's a pretty hard thing to predict. But we have collected flow data for different types of rooftop - general rooftop structures, flat roofs and sloped roofs.

The approach we use with those, and I can show this later when we actually look at the tool. But the approach is to combine the placement position on the roof with these - with the results of this flow modeling and the site's wind rows because as you look at these two pictures, you can see.

When you're on the windward edge of the building, you can get some of the acceleration that that building mount and turbine manufacturers are quick to point out as an advantage of their product.

However, if you - should the wind happen to blow from the other direction, you're no longer at the windward edge. You're now at the leeward edge. And you can see from the graph - the graphic on the right that's a much less advantageous place to be. You get a lot lower wind speeds, you get higher turbulence and your turbine is going to spend a lot of time sitting there doing nothing.

So by combining where the turbine is on the roof with where the wind is actually coming from, we're able to basically go back and build up that directional profile even for turbines that are mounted on buildings. This is just a bigger graph of the deciduous tree. On the right is a picture of the model we use for this particular tree.

The data we use for the micro-siting portions of this came from a lot of different places. One of our best sources of data were meteorological towers. We looked - we scoured all over the various anemometry loan programs and universities and other entities that are putting out met towers and are willing to share the data.

And primarily what this data was used for was to come up with realistic wind sheer numbers. I think one of the things that's really been a challenge as I mentioned earlier, to the correct use of wind maps and predicting performance has been nobody's put forward realistic numbers for wind sheer for different types of terrain.

So we've at this point looked at dozens of met towers and incorporated that into the terrain characteristics that are in DSAT. So in order to figure out - when DSAT calls a - the library and says what is the wind sheer for a dense forest, the number that it gets back is based on our analyzing data from a number of met towers in densely forested terrain around the country and coming up with that number.

So the numbers in there are based on real field measurements, not some made up number that we've dug out of the literature somewhere. The other thing we used extensively was wind tunnel testing. You know, I think that this was a bit of an interesting choice because a lot of folks would say and probably rightly so that a wind tunnel has nothing to do with, you know, a wind turbine out in a field somewhere in the real world. That is probably true.

However, the beauty of doing something like this is that the wind tunnel is a controlled environment. We have other ways to account for like for example using meteorological towers to get real wind sheer numbers to account for values in the field.

Something like a wind tunnel and the CFD modeling that went along with it let's us really isolate certain obstructions and types of obstructions and orientations of obstructions and get a much better understanding of how these obstructions impede wind flow. And then that in turn lets us build it into the tool.

And it all ties in with field experience too. We've done a lot of site assessments all over the country for distributed winds projects. And so we sort of have a sense at this point what works, what doesn't work, you know, what makes the tool usable. That's an important part of it as well because if this

thing were perfectly accurate but infinitely incomprehensible, we wouldn't be doing the industry any favors from that perspective either.

We also have a lot to draw on in terms of performance monitoring. With NREL on the team we obviously had a lot of access to the small wind testing going on at the test center, previous field verification project data. Cadmus and (NCRAFT) have also both done extensive turbine validation.

We made a lot of use of (NCRAFT) data from the Warwick wind trials and from subsequent studies of urban and building mounted wind in the U.K. where there's a - we have the benefit of having a high concentration of building mounted in urban projects there that we don't have here in the U.S.

If we were to try to find 50 building mounted turbine sites in the U.S. we would probably be going across, you know, across the country multiple times trying to fill that bucket. In the U.K. you can find 50 building mounted turbines within, you know, a three-hour radius.

So that was really valuable. The data we've been collecting Connecticut and other places has been really valuable in forming things like how, you know, system down time. Just understanding how systems perform in reality. So I think it's important to understand that it wasn't a bunch of software guys that put their heads together and developed this.

We brought in our expertise, our partner's expertise and we also partnered with a lot of folks in the industry in terms of reviewing the tool, reviewing out development plan for the tool and providing that kind of - that kind of industry feedback that we would need. So this has been developed as a pretty detailed and comprehensive process over the last - well really the last couple of years.

The - other than micro-siting there's a lot of important information that needs to go into it too in terms of system information. And I know the first thing that's going to come to everybody's mind and the first thing that came to my mind is well what about the Small Wind Certification Council. Excuse me.

The great work that they're doing is going to really help the industry standardize and report accurately how turbines should be performing. It's a great effort and we are fully behind it. Unfortunately as we developed DSAT that wasn't ready yet.

So initially we are - out database is populated with manufacturer-supplied information unless we had something - happened to have something compelling that we could use otherwise. But in general manufacturer supplied information.

We are monitoring SWCC and look forward to working more with them to make sure that as turbines are certified they get updated - not only updated in DSAT but emphasized because we do want to push the market toward certified turbines because that - you know, if we predict wind resource very well and we predict performance very well, that's all fine. But we need a good power curve to work with. So I see DSAT and SWCC as working really at very closely tied purposes here.

One of the things that we also are trying to do here that I don't think has been attempted before is to provide insight into the impact of the project. You know, I've sat in a lot of planning board meetings and something that always seems to come up is the visibility of the turbine.

And it's tough when you're in the position of the installer or the homeowner who's trying to get the permit to put up the turbine and you've got people

asking is it going to be visible from so and so's house, is it going to be visible from this park or scenic area.

These are all concerns that are faced by installers and perspective system owners. And so we've devised a way to help address that. And essentially what we do is we know the elevations, we know what constructions are being placed on the site, what - we know those things.

And so what we can do is we can calculate where in the vicinity of the turbine, the turbine will be visible from. So like in the example below, if you have a house and a turbine up on top of a nearby hill, you can draw a straight line from that house to the top of the turbine and reasonably determine that it will be visible.

What DSAT lets you do though is it lets you accurately say okay, but wait. There are going to - this happens - there happens to be trees in between. And the question is always well are they tall enough to mask the turbine from the sensitive receptor, the house. So we - using some calculations we're able to show that and we plot it on a map and I can show that a little bit later on.

So when you get your - when you're - the pro-user prints out their full report, it's something that they can literally walk in and hand to a permitting body who's concerned about whether or not the turbine will be visible for a neighbor's house.

You can hand them the report and say look at al the environmental benefits this turbine will provide, look how much energy it'll produce and look, because of all the trees or because of a big hill or because of whatever the case may be, it's not going to be visible from our neighbor's house and thereby

allay and hopefully - allay concerns and hopefully accelerate your permitting process.

So all of this is great. And I really enjoy talking about how DSAT came to be and what the - some of the nuts and bolts are. But at the end of the day what we want to know is does it work. And that was a - hat was a big goal of our projects from the outset is, you know, not only to build something that looks really cool and did a bunch of neat stuff.

That's something that's actually accurate and something we could demonstrate worked. And, you know, like I said, I think to date that data has either been rather sad in terms of things not working or lacking altogether.

So we looked at - I would say our total number of sites that we examined was about 110. Of those about 30 or 40 were located in the U.K. and are focused on building mounted turbines. And of the remainder we were able to collect valid performance and data and site characteristics for 39 sites in different places around the country.

A lot of them came from our previous experience in Massachusetts and Vermont and we also pulled in quite a few from California and from the Midwest. We made good use of the wind for schools program to get some of those - especially some of those midwestern turbines. And we were able to get data across a pretty big range of turbine types, terrains, hub heights, wind regimes.

And we slice the results different ways and looked at - looked for potential (bio feeds) by terrain type or (bio feeds) by turbine model just to try to understand where the weaknesses might be.

So the process was for each of the sites we would visit the site, we would confirm the equipment, tower height, turbine make and model, the date it was installed, find out about any downtime maintenance, equipment failures, all of that. Classify the terrains and obstructions and do a full site assessment.

Then we ran an MCP analysis. That's basically just to determine whether or not the winds during the operational period of the turbine were typical or not. And if they weren't, how should we adjust the wind speed in DSAT to accurately reflect the wind that the turbine saw.

And then we ran the model for each of the - each of the sites. And I think we did pretty good. I know I was pretty happy when at the end of all of this this graph popped up on the screen.

What we have here is we have the 39 sites. Along the X-axis we have the observed energy yield in terms of annualized energy production. And along the Y-axis we have what DSAT predicted.

Now in a perfect world what you would see is you would see a line with a slope of one going through this - going through this will all of the points clustered on that line. And in reality what we get is actually very close to that.

If you look at the overall error across the population, we predicted the energy output of this population to within less than 2% of actual. Obviously though, there's a lot of variability at the site-by-site level. You know, nuances to the site and terrain and wind resource that are just hard to account for. So for any given site we would expect our error to be plus or minus 27 point - a little over 27%.

There's no observe bias, which is great. It means that in general we don't either over predict or under predict. The slope of this line is essentially one. And it's got a good agreement with the linear aggression.

In layman's terms what it means here is that as far as I know, I haven't seen any other tools come forward that have been willing or able to produce this kind of a graph and say how accurate they are in reality. Maybe they have and I'm not aware of it, maybe it's in the works, I don't know.

But the bottom line is is that, you know, here we have a number we can hang our hat on and say that for any given site where you run DSAT and you measure you actual output, this is - there should be good agreement between the two.

Will there be outliers and anomalies? Of course. It's a computer model. We also can't control exactly how people use it. The best model can still be misused. But overall I think we've done well. And I was pleased to see this.

The performance of building mounted systems is still being analyzed. The data there is not what we would hope it would be in terms of the actual output. A lot of metering happened but translating that metering into something usable for comparison with DSAT has been a challenge. So that effort is ongoing and I hope we can report those results soon.

But initial results look promising. I would expect it to be less accurate in predicting building mounted turbines performance but of similar order of magnitude. So stay tuned. You know, we'll be updating our Web site with that information as it comes out.

As far as other estimating tools go, there's a lot of - a lot of options out there. You can go to most manufacturers' Web sites and find some flavor of free maybe spreadsheet based or basic online calculator to predict how - and these calculators are sort of generically called wind CAD models. I don't know who coined that term but that's been the name given to them. And they've been used for a long time in a lot of different ways.

People have built customized version of them. Our model (Quest) is a modified wind CAD model at a very basic level. Some of that functionality is still in DSAT. But the problem is is that if you just download one of these tools and start using it; the results are going to be all over the place.

This is the same graph I showed a moment ago except that now what I've done is I've taken those same sites and ran them and run them, sorry, with a basic wind CAD model downloaded from one of the manufacturers' Web sites following the instructions on the spreadsheet exactly where it gave you the range of wind sheers to use and the range of turbulence intensity values to use and all of that.

And you can see just by looking at this there's really no comparison. The - unless you're a very savvy user who knows how to adjust the wind CAD model beyond what's described in the instructions - you know, for example, I know some installers who are very sharp and know a lot about site assessment. And they use a wind CAD model and their answer is well, I run wind CAD and then I take 50% or 40% off the top. Okay.

And they get numbers that are pretty close to reality, which is great. There's a couple of downsides to that. One, it's a little hard to standardize and two, unless you've got some strong program requirements to back it up, who are most homeowners going to buy a turbine from? The guy who tells them it'll

produce 4000-kilowatt hours or the guy who tells them it'll produce 8000-kilowatt hours.

Probably the guy who tells them eight until a year later they realize that that was probably a bit optimistic. So free tools are definitely out there and definitely usable but the amount of experience needed to run them and the effort required to standardize how they are run is a big challenge as I see it. So they're hard to standardize.

There are other tools out there that you can buy. They tend to be expensive. I would say they tend to be fairly untested in terms of performance against the real world. And sometimes you've got to wait for your results. You punch in a - you punch in your site coordinates and hit a button and wait for somebody to send you a report or give you a call back.

And as I see it, that doesn't fit well with the needs of the industry. As I said earlier, I think the key thing to give people is something that's inexpensive, accurate and quick. And so that's what we've tried to do.

The future is ahead of us and we're really excited about it because there's a lot to be done. I'm happy with where DSAT is and then I think a lot of folks are happy with where DSAT is. But we aren't about to sit on any laurels by any means. We've been working for some time now on adding an acoustic impact module as well.

If you look at tools that - software tools like WindPro where you can have the privilege of paying several thousand dollars to buy the software, you're able to do things like determine how much noise a turbine will generate at a nearby house that may be concerned.

We're going to add that directly into this tool and take that from the realm of the high priced consultants and large developers to something that even small-scale developers and installers can make use of.

And economics is also really important. You know, we know that in small - average small wind system owner is going to think a lot about systems and payback and return on investment. So we're going to be addressing that as well.

And as I alluded to earlier, DSAT as a tool is great. The benefit is of course, as I mentioned, you know, since we're actually working in wind power and not just developing software, we're in a good position to help them make choices about siting turbines, selecting turbines, procuring turbines.

We do a lot of work with clean energy funds. So, you know, we can help them integrate DSAT into programs. For example, we can take the report that DSAT generates and make it automatically generate and application for funding thereby saving the installer and the program staff time making more money available for rebates.

There's a lot of - a lot of opportunity and a lot of benefits that we can have and we're excited to explore those. And of course maybe most importantly we want to do more testing. Initial results that I showed earlier I'm happy with. But I'd like to do better.

I think that we can do better and I think it behooves the industry to critically look at all of the available tools, DSAT included, and really put them to the test in the field and determine how they work. So that's a big focus for us.

At this point I think I'd like to open up the floor for questions. (Sharon) are you there?

Coordinator: Yes I'm here. Thank you. We will now begin the question and answer session. If you would like to ask a question, please press star 1 on your touchtone phone. Please un-mute your phone and record your name at the prompt. That's star 1 if you have a question. You may withdraw your request by pressing star 2. One moment please while we wait for the first question.

Our first question comes from Brent Summerville. Go ahead sir. You may - your line is open.

Brent Summerville: Hi Shawn. Thanks. I went through that - the DSAT model today. I have a question. Is there guidance provided for the miscellaneous losses table on the project overview page?

Shawn Shaw: In the user guide we make mention of it but I don't think we've done as much as we could to give people more guidance on that. We were shooting for that. I don't know if you're familiar with PVWatts.

Brent Summerville: Yeah.

Shawn Shaw: That was kind of what we were - the kind of thing we were shooting for with that miscellaneous losses section. So that's something we could do a little more work on. But in general it's based on what we've seen from monitoring turbines in terms of looking at how often they tend to go down due to random events and weather and just strange happenings.

Some of the data like on blade weathering came from California a few years ago. So I think we've used the same number, about 14% as a general loss

number for a while now. But we can certainly do - add some more documentation or guidance about that in the user manual.

Brent Summerville: Okay. Thanks. So when you did you comparison to the - in your comparisons to actual kilowatt hours produced on a site, you typically used 14% in the top conversions/equipment losses and just zeros for the five below that.

Shawn Shaw: Yeah. Well they all work the same way. You know, I mean the number 14% could be moved up or down. In fact it's a conglomeration of each of those.

Brent Summerville: Okay.

Shawn Shaw: So yeah. But that's the number we used. There was no reason to use otherwise in our case.

Brent Summerville: Okay. All right. Thank you.

Shawn Shaw: Thank you.

Coordinator: Once again, if you have a question, it's star 1 on your touchtone phone and record your name at the prompt. Our next question comes from Heather Rhoads-Weaver. Go ahead. Your line is open.

Heather Rhoads-Weaver: Oh hi Shawn.

Shawn Shaw: Hi Heather.

Heather Rhoads-Weaver: Say I'm just curious. I was glad to hear that you said you would be prioritizing the SWEE certified curves in some way. But so, you know, there's two that have been certified so far, the (Burgi10) and the Skystream.

Shawn Shaw: That's right.

Heather Rhoads-Weaver: And have you been able to put those certified curves into the model yet or if not, when do you think they would be loaded up there?

Shawn Shaw: We haven't yet. But they are - that is something that we'll be looking at doing over the next couple of weeks. It won't take very long once we do it. But frankly we've been pretty flat out and haven't had a chance to.

I want to work with SWCC and see if there's a way to automate the notification process so we can, you know, stay as up to date as possible on getting those certified power curves in.

Heather Rhoads-Weaver: (Unintelligible)...

Shawn Shaw: And as I mentioned, we also...

Heather Rhoads-Weaver: ...RSS feed you can subscribe to from the SWCC Web site.

Shawn Shaw: Yeah.

Heather Rhoads-Weaver: So you can be notified any time the table gets changed.

Shawn Shaw: Yeah. Yeah. And I subscribe to that. So we will be - we will be making those updates to those two turbines though.

Heather Rhoads-Weaver: Great. Thanks.

Shawn Shaw: Yeah.

Coordinator: I am showing no further questions at this time.

Shawn Shaw: Okay. And just to follow up on what Heather was saying there a minute ago, I - our focus right at the moment is setting this up. As of Monday of Tuesday of next week you will be able to access the site and - you can access the site now and set up an account. We're going to be adding in the ability to go - to upgrade to the professional account on Monday or Tuesday.

So I would say by the end of next week we should have the SWCC power curves updated. And then from there we're going to - we're going to look at ways to emphasize that certification to drive more people, you know, to encourage more people to select those turbines for their sites.

So I think at this point we seem to have some time left, which is good. And I'd like to, if I don't blow up the interface, have a look at the tool itself. Let me see here. Bear with me. Ah. Okay. I think that worked. So let me just go back to the home screen. I'll even - let me start right at the - right at the beginning.

So this is the DSAT homepage. Basically you have a login over here. If you don't have an account, it's very simple. You just go to register an account. All you need to put in is your email, password and we have this here to make sure there's no, you know, robots trying to put up wind turbines anywhere.

Once you are logged in you get a page something like this. You can see I've already got a bunch of projects and stuff started. But the basic structure that DSAT uses is projects and sites.

So if I got to projects, I've got a list of all my different projects here and I can talk about different descriptions of them. I can add a new project. Let's say I want to make this my ASES demo project. Oops. And this is handy because what you can do is you can create a project and then you can create multiple sites under it.

So uses of this might be if you for example have a farm somewhere that you're looking at a possible turbine for. You can create a, you know, Joe's farm project and then create different alternative sites under it. That can be moving the turbine from one location to another. It can be putting in a different turbine, anything like that.

So once you've elected to create a site within your project, you start here. And we have this sort of site configuration wizard. Basic information. You start here. You name your site. You can add things for, you know, descriptions and client name for the report if you want to - if you want to do that.

And once you're in here, you can select your turbine. Now here's a turbine from Bergey for example. And let's say you aren't too familiar with the turbine. You're kind of curious about it. You can pull up specs on the turbine, have a look at its power curve, find out how long the warrantee is on it. You can look at your sound rate and sound - yeah. Sound pressure levels, you know, just the basic - a basic summary of information.

Let's say we want to go with that. As I alluded to earlier, there's different ways you can mount your turbine. There's the traditional power mounted way at which point you go in here and you'd enter how many meters tall your tower is. Or you can say you're going to put it on a building. And you can select some different types of buildings.

So for example, if I've got a house - I'm not advocating by the way that you put a 10-kilowatt Bergey on a house but let's go with it. And let's say that the ridge of that roof is sloped North to South. Now this won't capture every single type of building out there. It's not meant to. But try to get close.

We have a North South oriented roof. Another question is where on the roof is your turbine. Is it on the East edge of the building, on the North edge? Is it smack in the middle of your building? And so once you do that you say okay great. How tall is my mast height, which is the height above the roof and how tall is the building itself?

And from there it calculates hub height. If I put a five-meter mast on a ten-meter building, hopefully that says something like 15 meters. There we go. And you go along that way.

Let's stick with the tower mounting for now. The remaining steps don't really change all that much so you're not missing anything. And just for (yucks) we'll put a wind turbine up at our office, which is not a good spot for one but again, go for it.

Zooms in. You just type in an address. You can type in your latitude and longitude, whatever you have. And so here we can see lo and behold that happens to be our office. It's not the best place ever. But let's say you're a little off and we actually oops, it's in the middle of a parking lot. You can put it there.

And you can pick a default terrain type. So something like this is urban. And there you go. And let's say you want to see what the wind resource nearby is.

So I just picked 50 meters. I can pick 30 if we want. But let's go with 50. And I can mouse around and see how my site compares relative to what's around it.

So maybe it makes more sense to - look, it's a little faster over here. I can move my turbine over to where it's a little windier. Not much different in this case but sometimes there will be.

Anyway. So when you're happy with where your location is, hit finish. And what it's doing right now is it's creating your site. So our site was saved successfully and our elevation data needs to be updated. No problem. Just go right here. And we can go to USGS or we can go to Google and we can download their elevation data.

Where we are we're pretty close to sea level. It's not going to make a heck of a lot of a difference. But anyway, there we go. And so now we've got a picture of the Bergey. We've got a description of what we should be doing next. Need to add some obstructions and we need to download the report.

So right over here we've got everything in order for us. So the next thing after the guided setup in this case is the terrain. And then I'll show you this is - this will look familiar. I showed a screenshot of this in the presentation. But once it loads up what we'll see is we'll see the site surrounded by its 16 direction sectors like this. And I guess I picked kind of a lousy site because it's all about the same.

But our default is is that for an urban site the canopy height is 20 meters. You can click on this and change it. And the solidity is one. Well, let's say I want to pick something else. Let's say it's forested. No problem. Go here. Find yourself let's say a sparse forest. That sounds good. And we have default canopy height of ten meters and a default solidity of .56.

So solidity is kind of hard. I mean if you've got a compelling reason to change it, go ahead. But canopy is pretty easy. There's lots of different ways to measure the height of things. And if you're saying gees it's sparse but tall, I've got, you know, 20-meter trees. Sure. Okay. There we go. And you can do that for each of these different direction sectors.

Once you're happy with that, you can add your obstructions. So here we are. Now an - worth noting here is that if you've already defined - like for example. If I've already defined this as an urban terrain, I don't need to go in and put each and every house. It's all - the DSAT already recognizes it as a canopy.

The point of the obstruction is to note things that are out of the norm for that terrain. So if you have a field with one tree in it, you wouldn't call that forested terrain. You'd call it cropland terrain and put the tree in as an obstruction.

And that's easy to do. Let's say I want to add a tree. We'll add an evergreen. There we go. Let's add an evergreen tree. And let's say we want a 15-meter evergreen tree. Add to the map. And let's put it somewhere. We can add another one that's somewhere else. Add another one. So. And you can pick all sorts of different types of obstructions.

We have conical hills, different sized houses, all kinds of things. And they're denoted by different colors on the map so it's easy to tell later on what you added.

So when you're done with that, you can go to wind resources. Now this is all automatically filled in. But sometimes people show up and they have data like

they've looked at - they have a weather station at their house and they know that the wind really comes from the North instead of the Southwest. So you can mess around with this.

Wind speed I'd say adjust with caution. But you can also change that if you've got alternative data. Let's say you buy one of the fancy wind resource reports or virtual met masts results from AWS or three tier and you're just itching to use that data you just paid a lot of money for. You can put it in right here.

Similarly if you have a reason to think that the wind speed needs to be de-rated where you are, you can do that right here. The economics and acoustics module still being built so there's not much to see there. But now we're essentially done setting up the site and we can go and we can download the full report.

And what this is going to do is it's going to crunch for a minute and spit out a printable formatted PDF that we can save to our desktop, email to people, use to submit grants applications, all of that kind of stuff. Excuse me. It's kind of a big file so it takes a few minutes but we'll see that in a second.

While it's downloading, (Sharon) I think we could probably take another question.

Coordinator: Thank you. Once again, if you have a question, please press star 1 on your touchtone phone and record your name at the prompt. That's star 1 if you have a question. One moment. We'll see if we have any question (to ask). We do have a question from Heather Rhoads-Weaver. Go ahead. Your line is open ma'am.

Heather Rhoads-Weaver: Oh hi Shawn. Yeah. I just had another question about your pricing. I think I saw that it was $99 and I'm just wondering if you've ever thought of doing kind of like a bulk discount or something like in partnership with DWIA for their members, something like that, that might make it even more accessible to people for the full reports.

Shawn Shaw: Absolutely. We've talked to some of the clean energy funding agencies preliminarily about it. We've got some good interest there. I think there's definitely a lot of opportunity to do something like that. And, you know, if it makes it easier for DWIA members to get access to it or if DWIA wanted to find some way to, you know, facilitate access for their members, we'd be really interested in working that out.

Heather Rhoads-Weaver: Great.

Coordinator: We do have another question. You ready for another one?

Shawn Shaw: Sure.

Coordinator: Our question comes from Mick Sagrillo. Go ahead. Your line is open.

Mick Sagrillo: Hi Shawn. How - going from the wind maps down, how far close to the ground is this tool reliable for? In other words, if you're using a 30-meter map or whatever and going down (unintelligible), you know, you were talking about putting a Bergey on a rooftop.

How - but you do - I mean yeah, I know it's laughable but you do have rooftop options and I'm wondering how far down you can actually go or think you can go and accurately predict what the output or the performance is going to be for turbines.

Shawn Shaw: Well what I can - what I can say based on the data we've collected so far is that we do well with the 40 foot Skystreams using the 30 meter layer on the wind map. In fact...

Mick Sagrillo: Assuming an open site?

Shawn Shaw: Not necessarily. Assuming the site that's really there. Now most of our - most of our - most of our sites where we tested the Skystream on the 40 foot towers tended to be in Midwestern sites but there were buildings and stuff around them because they were with wind for school sites. So not necessarily in the trees but a real site with obstructions on it.

In terms of looking at systems that - at a distance above the roof, we are doing pretty well with results that are within .1 to .2H above the building or 10 or 15 feet. But those - we're still working on those on the building mounted part of it. That data's based on like the Warwick wind trial sites and stuff and some of that is - some of that data's a little hard to sort of sift through.

Coordinator: We do have another question. You ready for another one?

Shawn Shaw: Sure.

Coordinator: Mike Bergey, your line is open.

Mike Bergey: Thanks. Hi Shawn.

Shawn Shaw: Hi Mike.

Mike Bergey: Two questions really and I apologize. I wasn't able to catch the first part of the presentation. If you already told everyone else this, my apologies. What is the source of your wind data?

Shawn Shaw: Sure. The underlying wind map data is the 2003 NREL validated maps.

Mike Bergey: Okay. And then the second one. I was surprised at the difference between what you call wind CAD and that was something that I named about 25 years ago...

Shawn Shaw: Oh, okay.

Mike Bergey: ...on a Apple 2E. But the - I was surprised at the vase difference and I wondered whether, you know, I know the innards of all of these calculations methods. And I just wonder if you had a site that followed the general rules of thumb for small wind turbine siting, you know, 30 feet of bottom of the rotor 30 feet above obstacles within 500 feet. Do you think you'd see that kind of difference or what we...

Shawn Shaw: No.

Mike Bergey: ...or what you're seeing is really sort of the effect of low towers relative to local terrain.

Shawn Shaw: Well that's a good question. I think - I obviously have a lot more faith in the more - in like the wind CAD results in less complex sites. And if you are a savvy user like I mentioned, you can take a wind CAD model and make an accurate prediction if you've been doing it for a while and you know all of the tricks.

The trouble is is standardizing that I think.

Mike Bergey: Yeah. But I was really shocked to see a 50% discrepancy. I mean that's just well beyond what I'm used to seeing.

Shawn Shaw: Well...

Mike Bergey: But my familiarity is with our sites and we tend to use taller towers.

Shawn Shaw: Yeah. There were a lot of - there were a lot of - 100 and 120-foot towers mixed into that dataset. In fact that was probably - 80 to 120 feet was the vast majority of those sites. But they weren't by and large necessarily simple sites.

I would say - let's see here. Let me get - give me one second if I can figure out how to go back to that for a minute.

Mike Bergey: And while you're doing that I'll just...

Shawn Shaw: Yeah.

Mike Bergey: ...opine that the power curves coming out of the certification program that, you know, meet the AWIA standard - the IEC standards are just better curves.

Shawn Shaw: Absolutely. Yeah. And we're using...

Mike Bergey: They're better curves for Bergey turbines I can say that.

Shawn Shaw: Yeah. Congratulations on - I don't know if you were literally first out of the gate but first of the two out of the gate anyway. That's great.

So looking at our data, we've got a good breakdown. We've got about - I think you could take and consider about half the dataset to be in complex terrains like forested or suburban areas versus the other - about half the dataset is in agricultural or grassy environments. And yeah, most of the tower heights were between 30 and 50 meters. Only one 50 meter. Really they were mostly 30 or 40 meter, in that range.

So there's - you know, we tried to get a pretty broad representation and we've got what - seven different turbine models represented in there. So I mean, you know, I'm not saying that somebody who was working in that area and knew their turbines really well wouldn't be able to come up with a better wind CAD.

I was just saying that if you literally follow the instructions on the wind CAD where it says - I think most of them say something like hey if it's a really rough site, you might want to use a wind sheer as high as .22. That's pretty low compared to what we've been seeing.

So I think that's really where I would look at it and say yeah, maybe the wind CAD is a little harder to use. That's all.

Mike Bergey: Thanks.

Shawn Shaw: And Mike I'm sure you could take a wind CAD and come up with something really accurate. A new installer who is just sort of following the directions on the sheet and didn't know quite what they are up to might be a bit of a different thing.

Coordinator: I am showing no further questions at this time.

Shawn Shaw: Okay. Let's see. Where were we? So I was just going to show a sample report here. Sorry. Just bear with me for one second.

There we go. All right. So hopefully you guys can see these things now. Okay. So you've got your - this is basically just a run through of what the report looks like. I don't even remember quite what all I put into this one. There we go. Okay. Happens to be an endurance project in this case.

So your front page you've got all of the things that, you know, you could have put in in the beginning if you wanted to write about, you know, who your company is and who you prepared the report for.

You can see some basic site summary information. So report author, date, latitude, longitude, the elevation of the site, all of that. You can look at the direction and the type of terrain you added. You can look at what the wind sheer exponent and canopy height and solidity are for all of those.

The nice thing down here is we've added the ability to look at what the ten most significant obstructions to your wind are. So if you've added a bunch of obstructions to your site, DSAT can tell which one of those is causing the most reduction in your wind speed.

Now that's not to say you may want to whip out your chainsaw but it may be something that's useful to you if you - if there's a small stand of trees for example that you can show is having a significant impact on your wind resource. This is the - this is where you would find that out.

Some information on your wind resource, the direction, the wind rows from it, your probability distribution, how much wind do you get for, you know, how much time you spend getting wind for - at each speed bin. Obviously the (par)

people are really going to care about how much energy does the thing generate.

The - from a bigger turbine, a 55-kilowatt turbine from (unintelligible) and they're generating a lot of energy here. We sort of come up with the environmental benefits, you know, we're using a bunch of e-grid or EPA type data to come up with the 4emissions factors based on local fuel mixes.

So it ties into what state you put in as far as how much CO2 your average electricity is responsible for generating and gives you the offsets for all of that.

And then - see. So that's the basic report. You can look - you can download individual pieces of it. In this case just go back to this site. You can look at the visual influence report. And I don't know that I added much in here that will impede the visibility of the turbine. I think I only added one small - a couple of small obstructions. But we'll see.

While that's loading, one thing I will - I just wanted to also call your attention to is we do have a help page. And on that help page we have a user guide here that takes you pretty thoroughly through the process of setting up a site and doing all of that. So I won't read this to you but it's got at a screenshot level step by step how to set things up and what things look like.

Basically everything I just did but with more details and description, more data. It's also I - we also included - okay, yeah, here's the visual influence maps. You can see what it looks like.

So if you put a turbine here and you have an obstruction, in this case we put the obstruction there but you can see that behind the obstruction it's not visible.

We also have a section on general site assessments. Yeah. So see right here. Here's the turbine. Here is where it's not visible from because you're sort of standing in the shadow of the building.

Just some general resources on site assessment and principles to use, how to classify terrain, all the kinds of things that whether you use DSAT or use anything else it's still useful.

And then at the end of that - end of the user guide we also provide a survey form you can print out and take onsite with you and make notes on it so it's easy to come back and then just put everything in. And we've also provided copies of all of the DSAT libraries in the user guide.

So any questions after this of course give me a call or an email. My info is in the presentation. Or of course feel free to log onto the site, set up an account, play around with it. Love to hear any feedback that you all might have. And, you know, look forward to hearing that and check out the user guide. If you have questions or like I say, just shoot me an email or a phone call.

I think we're just about out of time. Well I guess we have a few more minutes if there are any last questions. (Sharon) do you want to open the floor up again?

Coordinator: Certainly. If you have a question, please press star 1 on your touchtone phone. Please un-mute your phone and record your name at the prompt. That's star 1

for a question, star 2 to withdraw your request. One moment. I believe we have one coming in.

Our question comes from (David Bamiano). Go ahead sir. Your line is open.

(David Bamiano): Hey Shawn, how are you?

Shawn Shaw: All right. How are you?

(David Bamiano): Very good. I was just curious. Everything is in meters. Are you going to add a component to allow - put it in feet?

((Crosstalk))

Shawn Shaw: Yeah. Yeah. We know not everybody thinks in meters. So yeah, we are going to add a selector. We haven't decided yet whether it'll go under each user's profile or whether we'll handle it some other way. But that is in the works. Yeah.

(David Bamiano): Okay. Thank you.

Coordinator: Once again, if you have a question, it's star 1 on your touchtone phone and record your name at the prompt. One moment. We'll see if we get any more questions in.

Shawn Shaw: Okay.

Coordinator: We do have a question from (Brian Allison). Go ahead sir. Your line is open.

(Brian Allison): Hey Shawn.

Shawn Shaw: Brian.

(Brian Allison): Yeah. I just had a quick question basically regarding the turbines that you guys have as far as selecting.

Shawn Shaw: Yeah.

(Brian Allison): You know, are you ever going to lower it down to for instance 1.2 kilowatts, you know, vertical access Windspire turbines because that's smaller than your 2 point - I think you said 2.4 was the smallest?

Shawn Shaw: That's the smallest in there right now. That isn't - there's no cutoff per se. It just so happens that 2.4 was the smallest that we initially populated it with.

(Brian Allison): Got you. Got you.

Shawn Shaw: So yeah. We would definitely consider adding other turbines and we already have been - have received a number of requests to add other turbines. So that'll be happening as time goes on.

(Brian Allison): Okay. Okay. Sounds good. Thank you.

Shawn Shaw: Absolutely.

Coordinator: Once again, if you have a question, it's star 1 on your touchtone phone. One moment. We'll see if we get any more questions in.

I am showing no further questions at this time.

Shawn Shaw: Wow. I'm surprised. I guess we'll actually get done early.

Karin Sinclair: This is Karin. I just want to thank Shawn for giving us the presentation today. And I also want to thank everybody that called into this Webinar. It seems to me that there's a lot of interest in these Webinars. So we'll keep doing them. And you'll get emails on when the next one is scheduled for and what the topic is. So I guess that's it.

Shawn Shaw: Great. Well thanks Karin and thanks everybody for tuning in today. There's my - my info should be up on the screen if you have questions and the link to DSAT's on there too. Is that going to be going around in an email Karin at some point?

Karin Sinclair: I think everything will be posted and then people can go get it if they're interested.

Shawn Shaw: Okay. Great.

Karin Sinclair: All right. Thank you.

Shawn Shaw: Thanks a lot.

Karin Sinclair: Bye.

Shawn Shaw: Bye everyone.

Coordinator: This concludes today's conference. Thank you for your participation. You may now disconnect.

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