Collegiate Wind Competition Informational Webinar
October 22, 2018

BETHANY STRAW: Welcome to the Collegiate Wind Competition Informational Webinar. I'd like to introduce Amber Passmore from the U.S. Department of Energy, our competition manager.

AMBER PASSMORE: Yes. Hi. As Bethany mentioned, my name is Amber Passmore. I manage the Collegiate Wind Competition (CWC) on the U.S. Department of Energy side of things. We are really excited that the request for proposals (RFP) has been released. I want to welcome you all today and thank you for your interest in learning more about the CWC.

I joined the project back in 2015. I'm extremely proud to be a part of something that has had such an impact on collegiate students, and we hope as the competition continues to grow that it continues to have that lasting impact. We have a great team on the webinar today to talk to you about some of the highlights of the competition and what the CWC is all about. I just wanted to say a quick hello and welcome you all and for taking the time to be here today. So, let me go ahead and pass things back over to Bethany. Bethany, you want to introduce yourself as well?

BETHANY STRAW: Yes. I'm Bethany Straw with the National Renewable Energy Laboratory (NREL). I'm here with some co-organizers, Heidi Tinnesand and Elise DeGeorge, and we'll be reviewing some key details about the competition overall.

A couple of notes before we get started. If you do have a question that you would like to pose, please type that into your chat box in your control bar any time during the webinar and we'll respond during the question and answer (Q&A) period. We will not be answering any questions specific to the request for proposals. Any questions specific to the RFP need to be submitted through the formal channel that's detailed in the RFP. You can find that information on FedBizOpps. Any questions about what we review today, feel free to pose, and we'll answer as appropriate. We will be recording this webinar and making the slides and transcripts available afterward.

The Collegiate Wind Competition really is unlike any other undergraduate-level competition that you will come across, in its focus, breadth, and depth. It's an interdisciplinary competition and the motivations behind that interdisciplinary focus is that the wind energy industry is not one dimensional, and the competition shouldn't be either. At its heart, it's a workforce program in trying to get more curricula at the university's undergraduate level and exposing undergraduates to opportunities in wind, of which there are many. We want to cultivate creative thinking and problem solving to formulate novel solutions, and that requires a team of diverse backgrounds, and also wanting to expose these students to the comprehensive picture, not just one stand-alone piece of what the industry is made of or what wind energy development involves.

It intertwines academic course work with hands-on learning. It's a platform for Science, Technology, Engineering and Mathematics (STEM) education but also facilitates learning that can't be replicated in the classroom. It provides experience with real-world challenges. This is highly sought after by industry and hiring managers, which Heidi will touch on a bit more in a couple slides from now. It's also some of the best preparation you can have for a successful career in examining some real-world challenges and developing some novel solutions.

Direct interaction with industry experts—this occurs both in the structure and location of the competition. We want to introduce the next generation of the workforce to industry members and show students the diverse opportunities in wind energy, as I mentioned earlier. This is really supported by allowing for direct interaction with industry representatives, whether that be through our panel of judges or interaction at American Wind Energy Association (AWEA) WINDPOWER, which is the largest wind energy industry annually occurring conference, and that is where the 2020 competition will be co-located.

Then partnering with K-through-12 programs—there's a few motivations for that partnership. One is that it facilitates deeper learning as college students interact with elementary, junior high, and high school students about wind energy and sharing their own experience, and also is inspiring those younger students to pursue pathways to wind energy careers as they go on to secondary and higher education.

Just a quick overview of some feedback that we've gotten from participants, and this is both from students and faculty that have been involved. I'm just going to touch on some highlights.

The experience they gained over the past year, and particularly this past week—that's referencing the week of competition—will be invaluable as they continue their education and enter the workforce.

Opportunities like CWC have allowed many of us to land our dream job.

It's not comparable to anything students can get in a classroom.

Students from our institution were uniformly engaged and gained some experience that's impossible to replicate in a traditional classroom setting.

And some others as well.

HEIDI TINNESAND: Hi. This is Heidi Tinnesand with NREL. As Bethany mentioned, this competition is designed to really help educate and give hands-on learning for the next generation of wind energy workers. That stat up here really shows how we have big projections for growing the wind energy industry over the next 20 years,[1] and that means we're going to need a whole heck of a lot more people to join the workforce, and it's not just engineers. It's scientists and researchers, educators, every kind of engineer, as well as technical workers and technicians that are out there in the field, and a really broad set of folks, from project managers, marketing, finance, and business professionals. So, really, from soup to nuts, the entire industry. We will need folks that are excited to get involved in wind energy and passionate about making a difference.

Not only does it feel good to be part of the wind industry, the wind industry workers can really earn high-paying salaries across the field, whether you are a technician out there in the field or doing research and feeling good about that at the same time. Many of the careers don't require more than a bachelor's degree unless you really want to get deep into design or research, so a Bachelor's in Engineering is just a perfect way to join the workforce. Hands-on experience is really highly valuable to employers, and competitions like these are something that employers always love to see; being part of a team, figuring out how to lead, and follow through design from the beginning to the end. Not only do they need those workers of the future but developing the programs will help support the education of these future workers.

As Amber mentioned in the beginning, this competition began in 2014. It has historically traded between being at WINDPOWER, wherever WINDPOWER is that year, and being at the wind site (National Wind Technology Center), or the combination of a full challenge at WINDPOWER and a more focused technical engineering challenge here at the wind site.

In addition to that alternating configuration, there's been a theme each year that really helps students form the design of the wind turbine. In 2014, we had a lightweight transportable wind turbine challenge and then a more focused engineering challenge the following year, and then in 2016, it was designing a turbine that could supply electricity to nongroup-connected devices, with a load and really cool visual elements to that. Again, in 2017, we had a technical contest, but we added yaw to the competition, so really trying to simulate real-world experiences that turbines have in the field, and then we piloted a siting contest as a bonus challenge. We, as organizers, are always looking to evolve the competition and innovate what the challenges are to continue to make it fun and exciting and challenging and really to inspire and encourage that multidisciplinary engagement that we think will help students to become the best wind energy workers of the future.

In 2017, that siting contest was so fun that we decided to make it a full part of our competition [in 2018]. We provided a grid scenario with high contribution of renewables, which was a really difficult challenge on the electrical side, not only mechanical but electrical, and then we had a full siting contest, which you can see on the right and left. The right is the speed challenge, working 48 hours to design a big wind farm, as well as a business plan.

[1] U.S. Department of Energy, *Wind Vision.* 2015.

Getting a little more into the competition content, like I said, it's evolved a little bit each year, and I can't tell you too much about what it will look like exactly for 2020, but we know there will be these three main elements of the competition, that there will be a turbine design, so this is all the background, research, leg work, and calculations—everything that you do during the year to figure out what kind of turbine you're going to make—and then the turbine testing is where you bring the turbine to competition. You see one of our wind tunnels there in the background, and this is where you figure out how good all of your design was as we try to push your turbine design to the limit, and our tunnel is always trying to see how far we can push the engineers to design and innovate and create.

Then project development, which is evolving the siting contest. So far in the last couple years, it's site plans from an engineering perspective, and then a broad financial analysis; really diving into the levelized cost of energy. The past couple of years, most of the contest will have some sort of report or presentation, but we haven't released the rules or requirements yet. I can't tell you any of that.

Some other elements that Bethany alluded to in the industry are engagement and community involvement as well. These aren't required, but activities we think really have a high impact for the students. So, the industry engagement evolved out of many different opportunities, both a year-long research and investigation. We've had a whole lot of teams reach out to industry to get advice on turbine design, and also how to approach project siting, who have gone out and toured wind farms and had networking dinners and all sorts of great things, in addition to actually locating wind power.

And then the community involvement is something that we encourage through the RFP process. It really brings a lot of value to your local communities when you can engage with K-12 and the broader community to share your excitement and passion for wind energy with those younger students and the community at large.

This is our suite of competition wind tunnels. Last year, we unveiled the new wind tunnel, which is the one you see in front, as well as our two first-generation wind tunnels, which is the two you can see in back. As you might be able to tell, this one in front is about twice as big as the ones in the back. It's also much, much faster, so that is the bread and butter of the engineering competition, and over the course of 3 days, we try to give students as much time as possible to get into each of these tunnels and really hone in the controls of the turbine and just really get dialed in for the main competition day.

During [tunnel] testing, turbines are subjected to a lot of different tests. You can see how that's gone in previous rules and requirement documents. But we do cut in and then power performance test, several safety functions, a control at the top of the wind speed power curve, and then a durability test. You can also find specifications for the wind tunnel in Section 5 of the 2019 rules and requirements.

And this is just highlighting, really, the cool opportunity of being at AWEA WINDPOWER. You can see in all these slides we're located right on the show floor. This year, we were in the main entrance with all the student bullpens, and so there is a ton of opportunity for the industry to walk by, to engage with the teams, to ask questions, to come over and see tunnel testing, to watch presentations on the public stage, as well as we have industry judges for each of the competition contests. So that's really an opportunity for judges to get to know and get direct feedback on all of the choices that students have made, as well as each year we've had a sort of formal industry engagement. We had a 2-hour industry networking session this year, and we had a bunch of industry folks coming around and picking off the crème-de-la-crème students for their job. So, that has been really, really amazing to see the student engagement within the industry.

ELISE DEGEORGE: Hello. This is Elise DeGeorge from NREL, and I wanted to emphasize that your involvement in the Collegiate Wind Competition is a partnership with NREL and DOE, and we wanted to go through our commitment to the participants in the Collegiate Wind Competition. Some of these are listed here that we will host a full-service competition at AWEA WINDPOWER in 2020 that will ensure a fair and unbiased competition environment, with expert judging from across the industry. We provide $20,000 in seed funding. We'll expose your teams to wind energy educational opportunities, and you will

also be learning from one another, other teams that are involved, on how they have incorporated wind energy in their universities.

You have an alumni group that continues well beyond your team's involvement in the Collegiate Wind Competition, and we will provide opportunities to engage with industry professionals, as Heidi was saying; for example, what we did last year with the industry expo. There are also opportunities to engage with K-12 STEM education efforts, and you see right there, Mike Arquin with KidWind was very engaged with helping universities host KidWind challenges, and I think he's looking forward to doing that again this year. But there's lots of other things you can do as well.

Expectations from the team to the competition organizers are for you all to compete in the 2020 competition in a professional collegial atmosphere. We want you to commit to bringing wind energy education into the classrooms at your universities and supporting wind energy education at other universities as well. We expect you to further the $20,000 seed funding through fundraising, if at all possible. We would love you to be advocates for the CWC and spread the message through outreach and local impact and take full advantage of all the educational opportunities provided by us as organizers and your fellow teams and universities.

BETHANY STRAW: This is Bethany again. I'm going to review a few more details, and then we'll head into some lessons learned from principal investigators (PIs). So, right now we currently, as you all know, have a call for proposals out. The deadline for submitting those proposals is the end of November. Following that time, there will be deliberation and selection of the teams by our selection committee. And then we aim to notify and announce awardees by early March, so early spring of 2019, to give the selected teams that spring time frame before the academic year closes to begin recruiting or continue recruiting team members and co-PIs, mentors, advisers, planning curricula for the competition year, and determining how competition participation will be interwoven into the educational programs at the universities. During the 2019/2020 academic year, that will be product development and submission by the teams, and then the live competition takes place the first week of June in 2020, co-located with AWEA WINDPOWER in Denver.

So, for that academic year, what you can expect to see for that 2019/2020 competition participation, just a note, this is a high-level overview—and it's subject to change. But the ongoing engagement throughout the academic year involves development of contest products and product submission, faculty members supporting student learning on relevant subject matter, participating in local outreach, fundraising to further seed funding provided, and participation in all team calls and other communications with the competition organizers. The actual live event at AWEA WINDPOWER is a full 3-day event, starting with team check-in or registration; technical inspections, where we do a safety and compliance check; a hard start or kick-off meeting; tunnel testing practice and official tunnel testing; presentations relevant to the individual contests; an on-site siting contest or other on-site challenge; team expo and/or industry engagement; and the awards ceremony.

And then a quick reminder about the criteria for selection, as listed in the request for proposals, they are equally weighted between educational objective and integration, organization, and project planning team inclusivity, institutional support and fundraising, communication and outreach, and there is more detail on what this entails in the request for proposals. If you have questions, please submit those through the formal RFP Q&A process.

With that, we will head into some lessons learned, starting with Matt Shields, the former PI from Seattle University.

MATT SHIELDS: Yeah, thanks Bethany. This is Matt Shields, and as Bethany said, I was the PI from Seattle University for the 2018 competition, and, actually, last month I moved over to working at NREL here, so no longer involved with Seattle U.

But, I was asked to just give a little bit of a summary of what our experience was like and some major lessons learned for being a first-time competitor in the 2018 competition. A little background about the

university, which impacted how we wrote our proposal, was that we're a small, and, at the time, undergrad-only school. We didn't have a wind tunnel that was going to be suitable for testing in the competition, and there was actually no existing wind program. Some of the resources we did have, which, again, was something that showed up in the proposal we submitted in the competition, was access to three-dimensional printers, machine shops, well-equipped electrical engineering labs; we were able to leverage some senior design projects in order to get some good workforce dedicated to this project.

There were some internal funding sources that we were able to leverage, and we were able to buy time at the University of Washington wind tunnel, and also build a very basic wind tunnel involving leaf blowers and two-by-fours for a couple hundred dollars for the start of the competition.

So, in retrospect, looking back through the competition, I tried to classify some of the biggest challenges we had into a few main categories here, and I'll start by saying that the biggest challenge, which, if you've looked at previous rules and regulations documents, it's a highly complex project, and the students, particularly with Seattle University that had no existing wind power program, have a hard time wrapping their heads around what the scope of the entire project is. It really takes months to get a handle on that.

So, some ways that we addressed that were to really focus on as simple of a design as we could in all aspects of the design, both on the business side and engineering side, with the goal being to just get a working model that you can optimize later if there's time. We did some crash-course works in wind energy at the start of the school year to try and at least provide some introduction to the theory the students would need. We leaned pretty heavily on previous reports from the 2016 competition, and a good example of this is identifying tools and methodologies that were used by previous teams, and we were able to find some industry and faculty mentors who spent some time really getting to know the project and could help to steer the students in the right direction.

A really significant challenge of the project is how interdisciplinary the design process is. An example of that is how it's very difficult to design something like the blades or the generator independently without considering the dependency between the two. Our best recommendation for this is that you just have to start somewhere, right? Just pick an initial design condition, start building something, start working around that, and then modify that later, as time permits. Lean on commercially available or previously published results as much as possible, just to, again, get started.

Your subteams should meet frequently and understand what their colleagues are working on, and a goal of this is to not let teams get paralyzed. It's easy to get stuck sort of in the weeds of the problem, but you really need to continue moving on. And maybe the most useful information is to test as early as possible and as often as possible.

And a last thing I'll say, which relates to these first two bullet points here, is that communication is really key to this project, and that's within, really, all stakeholders in the project, just because there's so much information and data that needs to be shared amongst your team. It's really helpful to have a strong and well-organized student project manager or management team, with a limit to how much time the PI is going to spend in the lab with the team, so it's important for the students to take ownership of the project.

You really want to understand the rules and regulations document to know where to invest your time based on where the points are allocated in the rubric. You know everyone's going to have a busy schedule. It's rare that you're going to have the entire team in one room at one time, so be sure that you have communication protocols in place, whether it's using document sharing or file sharing, like Slack or something like that, to share information. And as much as possible, try to keep those deliverables for the competition in mind and schedule around that. And overall, it's just a really positive experience, and I encourage everyone to try and get involved.

BETHANY STRAW: Thank you, Matt. Now we will hear from David Alexander from Cal State University Chico.

DAVID ALEXANDER: Thanks for the opportunity, and thank you, organizers, for doing all the logistics and all that you do. It's been fantastic. Over the years, Chico State got involved in, gosh, what was it, the 2016, I believe, was our first event, and, you know, Chico State is a teaching university not a research facility, so we do have a closed-loop wind tunnel, not as big as the ones that are used at competition, so, you know, there's a little bit of a scale-up issue that our students run into, but we've been able to work with that fine.

We have, in the past, used senior design teams. We have mechanical and mechatronic students that are involved in the year-long Capstone Program, and that generally has worked well. And then I work closely with my colleague in business, Dr. Colleen Robb, and she and I work on a bunch of different entrepreneurial-type activities, so we're often involved in cross-disciplinary work, and this is really a big part of what we like to do at the university. So, that's just a little bit of a background on Chico and where we fit into the Collegiate Wind Competition in terms of our capabilities.

In terms of lessons learned, so, as I mentioned, we really like to approach it from a multidisciplinary standpoint, and we really like to get engineers and business students and environmental students and policy, planning, whomever. We even had art students. We really get as many different kinds of viewpoints and perspectives into one room, and then we try to create options for them to work together.

So, with the business plan aspect, that provides a huge challenge for different students to look at the problem from different perspectives but then try to reign it in and make some decisions, which can be very challenging. Oftentimes, the business students are waiting for the engineers to tell them what can be done, and the engineers are waiting for the business students to tell them what should be done, and it can take a while, and the little bit of paralysis sets in and you have to come up with ways to try to get them to make some decisions and move forward.

We have had teams of engineers give presentations to nonengineering students about wind power, and we have business students give presentations to engineering students about market research and analysis, and that kind of thing works really well student to student so that we're not up there yakking and they're involved, and we try to get the students to really own the project early on.

That being said, we do have to provide real firm internal deliverables. The students get busy, we get busy, and then if deadlines slip, it just can be a disaster, so we really try to establish some real firm deliverables and then hold the students accountable, and then encourage them to hold themselves accountable, and each other accountable.

We have, over the last year or two, developed some really strong relationships with some industry folks, and they have been a tremendous help, both in sort of the technology and the broader technological ideas or directions, but also with siting development and deployment, and that was really helpful. I highly encourage people to get involved with industry folks. And what's really fun about that is that the students really learn and grow and develop from working with a professional, and it's really neat to see that.

Obviously, sort of test early, get everyone involved early. You know, it's really fun to get something working in the wind tunnel and show business students how wind turbines work, and that really can be a strong motivator for the rest of the team, especially when they see things being accomplished, and it helps everyone move forward.

And then lastly, this is kind of a—I don't know, paperwork kind of thing—but I'm the one that ends up doing a lot of the travel stuff, and it always seems like there's this window of time that I'm trying to figure out, okay, who all is really committed, who all is going with us, because you've got to get plane tickets a couple months in advance, and you've got to submit an advance request and all sorts of paperwork. I don't know how other people's universities are, but the red tape can be time consuming, and so just getting that started early and really identifying that team that's going to competition with you as early as you can, it's a huge benefit, and then you're not sort of scrambling right at the end, trying to get everyone organized. So, that's about it. If anybody has any questions, I'd be happy to respond by e-mail or follow up later, or, obviously, at the end of this today.

BETHANY STRAW: Thank you, David, and you, Matt, as well. So, with that, that brings us to the end of our presentation for you all.

Just some reminders: proposals are due on November 30 and I encourage you all to review the previous rules and requirements documents. If you drill down into the CWC website and go to past competitions, go to competition year, and then individual team pages, that's where you'll find previous reports submitted by teams, and you can review those and see those products, examples of products that you might be developing with your team. And then it's never too late—sorry—never too *early* to start looking for team mentors and sponsors and just getting the word out at your university about this opportunity, and getting people excited about it.

With that, we can now open it up for questions. I haven't seen anybody submit anything through the chat box. We've got a number of folks on the line. Does anybody want to unmute yourself and pose a question either for organizers or Matt or David?

GORDON: This is Gordon at WSU. Can I ask a question?

BETHANY STRAW: Yes.

GORDON: So, as I just said, I'm at Washington State University Everett. We are a part of Washington State University, which is on the other side of our state. We are a branch campus that we only teach the last 2 years, so we only have juniors and seniors, and our campuses, we have a mechanical engineering program, an electrical engineering program. We also have a business school, which focuses on hospitality management, but there are business students that work with us.

My question, though, is, we are actually—our first meeting of our wind energy club is actually today in 2 hours. I have made a big point that I want to include the students from the community college across the street, which is Everett Community College. I noticed that it says that each team must consist of one 4-year university, and I'm wondering—I definitely feel that we meet the criteria of one 4-year university, but I'd very much like to include any students from Everett Community College as part of our team, and I'm wondering if the way the proposal is written, or the call for proposal is written, that I have to be very clear that our team must consist only of WSU students or if Everett Community College and WSU Everett can be considered one 4-year institution?

BETHANY STRAW: So, unfortunately, we can't answer that question right now. We will respond through FedBizOpps. But Kortni, our administrator on staff that is facilitating the FedBizOpps posting, is on the line. Kortni, do you have anything that you want to notify folks about or add?

KORTNI NEVINS: I think the best opportunity for everybody to receive the same information would be to post an amendment to the RFP on FedBizOpps, which would include a link to this webinar recording and to answer any written questions that have been submitted. I do believe we've received that question, and we will provide a response and an amendment shortly.

BETHANY STRAW: Thank you.

GORDON: Thank you.

BETHANY STRAW: Any other questions? All right. If no one else has any other questions, again, encourage you to submit those questions through the formal RFP Q&A process. Amber, did you have anything that you wanted to say in closing?

AMBER PASSMORE: No. Just thanks again. Appreciate your time, and we look forward to hearing from a lot of you.

BETHANY STRAW: All right. Thanks everybody. Have a wonderful day.

--END--