

Hayley McLeod:

Good afternoon, everyone, and welcome to Saving Energy and Money with the Building Envelope Campaign. Before we jump in, I just have a couple of housekeeping items to go over. So, this is the 2020-2021 Better Buildings Webinar Series, and in this series, we are profiling the best practices of Better Buildings Challenge and Alliance Partners and other organizations working to improve energy efficiency in buildings. Next slide.

So, I'm your moderator, Hayley McLeod, both in webcam and in that picture on the slide. I joined Oak Ridge National Laboratory almost a year ago, after five years in industry as a LEED Specialist and Sustainability Consultant. Now, I am a Technical Professional and Project Manager in the Integrated Building Performance Research Group, and I'm working on several projects across the commercial and residential building sectors, including serving as Campaign Lead for the Building Envelope Campaign.

We have two other great presenters with us today as well. The first is Dr. Simon Pallin. Dr. Pallin is the Technical Lead of the Building Envelope Campaign, so he is the Ph.D. engineer and I am the cat herder. He has worked in the building industry since 2005 and spent several years conducting research in Europe. He joined ORNL in 2013 and is now on the Building Envelopes research team. He serves as a Building Envelope Risk Assessment Expert and works with—sorry, and works with both existing simulation tools as well as creating new tools to estimate the hydrothermal performance of building elements such as walls and roofs. He is the technical lead for the Commercial Building Integration Team at ORNL, and is greatly involved in residential building research under the DOE Building America program.

And then last, but certainly not least, we will hear from Cristine Gibney. She supports the American Geophysical Union Building Team, which is striving to be the first net zero energy building in Washington, D.C., and she is a U.S. Army Strategist turned building scientist with a passion for building performance. She holds dual degrees in Sustainable Design and City Regional Planning from Catholic University of America School of Architecture and Planning.

So, that's who you'll be hearing from today, and we're really excited to be able to bring you Cristine's participant perspective on the Building Envelope Campaign.

So, thank you, all, for being with us today. We, like I said, just have a wonderful session prepared and some really, really great speakers. So—next slide, please.

Okay, so, this is just gonna give you guys a little bit of an intro of who we are.

[Video plays 02:50 – 04:22]

Okay, so, we should be moving on to the next slide. Perfect.

So, for our Q&A session and to do our polls today, we are gonna be using an interactive platform called Slido for Q&A. You're probably familiar with Slido if you've been on other Better Buildings webinars this season. So, if you could please go to www.slido.com using your mobile device or opening a new window in your browser, today's event code is DOE.

So, I'll give you just a second to—it looks like that link has also just been added to the chat, so thank you for that. And then if you would like to ask any of our panelists any questions, please submit them any time throughout the presentation and then, of course, we will have a Q&A session at the end. Please note that you can also select the Thumbs Up icon for questions that you like, which will result in the most popular questions moving to the top of the queue. So, in the case that we don't have enough time to answer all of them, we can make sure that we answer the most popular questions. So, next slide, please.

So, hopefully, you have all made it over to Slido and we want to learn, you know, a little bit more about you guys, our audience. So, if you would like to go to Slido and answer our first poll, it's just, "Have you previously attended a Building Envelope Campaign webinar?" and this just helps us to know how many new faces we have. And this is great, it looks like most of you haven't, and I love that, I love getting a new audience in.

So, I'll let a few more answers come in. That number is still going up. Oh, this is exciting! Gonna tell a lot of new folks about the Building Envelope Campaign. Okay, it looks like responses are slowing down. Give it another couple seconds and then we can skip on to the next poll. Yeah, I think we can go on to the next poll. Perfect.

And then this is just, "What type of organization do you represent?" I tried to put a whole lot of options in here but I'm sure

I didn't get them all, so please put what you think is the closest fit. Lots of government folks, no surprise there. But a good mix today—a good mix, I like that. Okay, and I'll give you guys another few as well and then we can jump into the meat of the presentation.

Okay, we can probably go ahead and close this poll and move on. And move on to the next slide—perfect.

So, here's our agenda for today, just to give you guys an idea of what to expect. I will walk through and do a kinda bird's eye view introduction of the Building Envelope Campaign, since so many of you are new. Then, we're going to get a walk-through of the Building Envelope Assessment Tool with Dr. Pallin, and then we are going to get into a case study with Cristine Gibney, she's gonna talk about their very cool building and will kinda give the participants' perspective on participating in the Building Envelope Campaign, and then we will wrap it up with the Q&A. Next slide.

Okay, so, you may have noticed that Dr. Pallin and I are both at Oak Ridge National Lab, and that is because that is where the Building Envelope Better Buildings Alliance Tech Team is hosed is at Oak Ridge National Lab. So, that's why Simon and I are both the co-leads of this campaign. Next slide.

So, this is our broader research team, and you see myself and Dr. Pallin there, but we do have a really great collection of people, including Dr. Mahabir Bhandari and Dr. Jason DeGraw, who are on our Tech Team, so if you ever e-mail me with questions, there is a reasonable chance that I will loop one of those fellows in to help get your answer, and then we also have Kita Cranfill, who is our amazing Full Stack Developer who has built out our website and tool. Next slide, please.

So, for the Building Envelope Campaign, what are our goals? We have really put this into three main categories. The first is to motivate action and increase awareness of the value of investing in high performance building envelope technologies. We feel like this has been a really underutilized space in the past, and so, we really want to help spur some market transformation in this area. We want to recognize leaders who are doing this by adopting and achieving high performing building envelope systems, and we want to demonstrate and document the energy and cost savings that can be achieved with these integrated design construction, commissioning, and maintenance of these high performing building envelopes. Next slide, please.

So, those sound like some pretty lofty goals. So, how are we planning on achieving these goals? And the short answer is, with broad industry engagement. I think that's kinda the only way you can achieve market transformation is with broad industry engagement. And a slightly longer answer is by recruiting supporters and participants in the Building Envelope Campaign. So, this was—this is kinda the way we split those folks that are interested in engaging with the campaign. So, supporters are going to be manufacturer's associations, firms without a building that they have at the moment to enter in the campaign. These are gonna be those folks that are really invested in the outcome of the campaign and see a need for transformation in this space, but who don't necessarily own or manage a building themselves that they can put into our Building Envelope Assessment Tool.

Participants are going to be building owners or managers or contracted by building owners or managers. So, you know, sustainability consultants, owner's reps, that kinda thing, who have the authority to enter their building information into the Building Envelope Assessment Tool and then be recognized for it.

Both categories are given access to the campaign and to the Building Envelope Assessment Tool. Both are given access to resources and both can be listed on the Building Envelope Campaign website as a supporter or participant.

One more thing I did want to note about participants, if you think that category is for you, is that buildings that have been completed since January, 2019 can be submitted for recognition for this first program year. So, that is almost two years of completed buildings that are eligible for it to be submitted. Next slide, please.

So, the campaign is open to new construction and retrofit buildings, and it is—so, we've broken the award categories out accordingly, or our recognition, we call them recognition tiers and categories. So, for the existing buildings, we call these Retro 30 and Retro 50, and so, this is gonna represent a 30 or 50 percent improvement in your building envelope performance between your existing building and the retrofit building. Next slide.

For new construction since we're comparing this improvement over relevant code, that percent improvement is a little bit lower. So, these are Novel 20 and 40, and so that's a 20 or 40 percent improvement over your locally relevant code. Next slide.

And then we have two more open categories. And so, we have role models that are going to be a participant that has submitted a building, hit one of those recognition tiers, but has also done something that we consider to be really above and beyond and that is truly serving as a role model within the industry. And then the other category, we have an Honorable Mention. So, for some reason, you know, you're really close to one of those tiers, you don't quite make it, but we see that you were limited by the fact that it was, say, a historic building, and so, we did still want to acknowledge your participation in the campaign.

We do also encourage, since these Honorable Mention awards are available, we do encourage you to submit buildings for recognition even if they don't quite hit one of those tiers. Next slide, please.

So, I did just throw a lot of information at you, but I'm gonna summarize it here kind of in terms of our timeline. We are currently open for new participants and supporters to sign up. You'll see this later in our deck, but it's just ec.ornl.gov, and there's information there to sign up as a participant or supporter, and we are currently accepting and reviewing submittals from participants.

So, if you have a building that you enter in the Building Envelope Assessment Tool that Dr. Pallin is gonna go over, we are encouraging you to go ahead and submit it and let us review it now instead of waiting until the last minute when we have a submittal deadline looming. We have not set that submittal deadline yet. It will be in the spring, and we just haven't set it, because we also have not set our recognition event for the summer in stone, obviously, because lots of things are in limbo right now, but we are expecting a spring submittal deadline and then a summer recognition event, so we will obviously advertise broadly when those dates are set.

I also just wanted to put two notes that these are always questions at the end, and it's fine if you ask again, but this campaign is free and obligation free to join. So, we encourage you if you're interested to go ahead and sign up as a supporter or participant, get on the listserv—you know, we don't spam you, we send out a monthly newsletter, and that way, if you do have a building in the future, you're already signed up. But again, it is free and obligation free to join.

The other thing I wanted to note is that it is really easy to switch from a support to a participant or vice versa, you just need to e-

mail me. So, if you think you maybe have a building coming up in the next year that you would want to enter but just want to be a supporter for now—again, go ahead and register and then to switch you over, you just have to send me an e-mail. Next slide, please.

Okay, we do have, I just wanted to throw this out here really quickly, we do have, to date, 39 registered participants, which represent over 250 buildings and 18,000,000 square feet. And then next slide—over 52 supporters. So, this network is growing and we will list you on the website if you would like to be; you don't have to be listed on our website. So, again, growing our supporters and participants are how we're gonna make this campaign a success. Next slide, please.

I would be remiss to not, at this point, say thank you to our organizers, the AIA, IFMA, and IBEC, who have been wonderful in helping us get this campaign up and running, have given us lots of great feedback. Next slide, please.

And so, now, we are going to play our second video for you, which will be an introduction into Dr. Simon Pallin's portion of this, and so, this is just a little bit more of a technical overview. Go ahead.

[Video plays 16:54 – 19:03]

Okay, and so, you can change it over to the next slide and then Dr. Pallin should be able to walk you through the Building Envelope Assessment Tool.

Simon Pallin:

Hello, everyone. I had some issues here with the computer, and I'm gonna try to turn off the camera and make sure that I have enough WiFi to make the presentation here, today. Can we move forward here on the slides? Awesome.

So, this is the website for the campaign, ec.ornl.gov. We can move forward.

So, like Hayley said here, I mean, the whole purpose of this campaign is to emphasize the importance of the building envelope and the thermal performance of the building envelope. So, we needed to figure out a way to evaluate the performance of the buildings. With new constructions, we decided to evaluate the performance based on code and then to, like Hayley said, with Novel 20 and Novel 40, to show, for the participant to be able to show us that they have, the performance is 20 percent better than

code or 40 percent better than code. And for retrofit, your base case would then be your existing building, pre-retrofit.

So, this is just a very quick introduction to the kind of information that is asked for in the tool. And the first tier—so, these are sort of snapshots from the website. The first thing we ask for is just the building description, it's up to you, whatever you want to name the building. It could be very useful if you have several buildings, obviously, to be able to name them, but nothing to be more specific, here about. Can I have next, please?

Then, the other thing here is the building type. So, like I said, you know, if it's new construction or a retrofit, the default is retrofit here and then it's important for us to know when the building was built. A lot of times, you don't necessarily know what's inside your building in terms of, you know, it's kind of insulation material, the thickness of the insulation material or other materials that will sort of impact the thermal performance. And so, by telling us when the building was built, that helps us understand and estimate based on the code at the present time, what potentially kind of insulation material and insulation levels the existing building has. Next.

So, then we obviously want to know where the building is located—a climate zone and what state also helps us with figuring out, sometimes just because the most recent code doesn't mean that the state has adopted that code and so forth. So, that also helps us a lot with the existing buildings. We need to know about the surroundings. That helps us estimate or appreciate the impact of wind loads and those help us with calculating the air leakage and the impact of air leakage. Next.

For geometry, we have chosen to use the DOE prototype buildings and there are several to choose from—large office, school, retail, hospital, warehouse, and whatnot. And by default, you will see these heights and length and areas and so forth, but obviously, that's something you do need to change to match your building. Next.

Yeah, so, just—I mean, the tool is built so that it should be easy to use, and in some cases, you just end up with, you know, you can't really figure out how am I supposed to deal with this and so forth, and obviously, we're here to help. Just reach out to us and we'll gladly help you in any way possible. But just quickly here, how do you handle complex geometries? Next slide.

And I can even get another click, please. This is the time when you regret all your animations, here.

So, to calculate the total window and wall area for each orientation, you know, that is not just like a shoebox shape, we ask the user to simply sum up the areas of the windows and walls facing for any given orientation. Next.

And this is just showing an example of what that would look like for a more complex kind of building. Next.

Then we would like to know about the building components and the material properties. Obviously, that's some very relevant information. You type in your R values of your wall, roof, and window U-factor and solar heat gain coefficient. And what if you don't know the wall R value but you maybe know the materials? And can I have another click?

Then we have this built-in R value calculator, so you just choose your materials and what's the thickness and so forth and add and remove materials as you wish, and it will calculate the R value for you. Next.

Which brings you back to this side, right? And what else we need to know, if I can get another click—yeah, yeah, yeah, how do we handle the multiple façades, right? So, in a lot of situations, we have different façade materials that we don't have one façade material for the whole building and how do we deal with that? Can I have a click? And maybe two more. There you go.

So, it's just a simple situation where you weigh the area of the wall or you take the R value and then weigh it towards the façade area, and then that can help you to calculate an equivalent R value for your walls, and that's how we want you to handle this kind of situation. Next.

And we need to know about the airtightness, as I mentioned, about the surrounding environment. We also need to know, of course, not just how exposed the building is, but also how airtight it is. So, we want to know if you conducted a blower door test and/or if you have taken any additional steps to improve the airtightness of the building. If no, then you know, we have our default value of what the assumed airtightness will be of the building, which is also dependent on the age. If it's a new construction, we have one value for that.

Now, if you say yes, then you can—yeah, that’s good. Yeah, one forward is fine.

Obviously, yes, you can type in your actual measured values, that’s great. If you say no, you can click again, but you have taken some additional steps towards improving the airtightness, then you can get credit for that. It can also be that we have had some situations where the measures you have done, your retrofit measures will contribute to improved airtightness of the building. So, then we can manually change that value if we feel that, you know, if we actually think that the airtightness is even better. So, again, it’s just, communicate with us and we’ll help you there. And one more click, quickly, here. I’ve kind of run through this.

This is just advanced options, so, if we want to put in the set points of the building and so forth, it could be very relevant. There are default values based on the type of building, but here you can change them. Next.

Just very quickly here, just review and acknowledge—and obviously, we need that information. Maybe this is just telling us that you’re willing to share some of this information with us and so forth. And then we go to the results page. Let’s see if we can get a click. And voila, we have our existing building and we have a retrofit, and the tool calculates the improvements, and it does it in the BEP value that was mentioned in that video we just watched. And here, you also see the specifics of what you added to or how you specified before and after, here. And obviously, for this case, it’s eligible for the Retro 30 award. Last slide, please.

The really cool thing about the tool is also that it helps you to advance 50 or so simulations after you click on submit to—or not submit, but to check the results. And it checks if you have some area where you can actually improve it even more. So, for this case, it identifies that airtightness, like, for this case, where the example here, nothing was done to the airtightness, so therefore, it recognizes that one as being something, if you want to improve it even more, you know, maybe Retro 30, then that would be something to target. As part of this, we also provide a lot of references and case studies and other resources that could be useful, and that will be given on the website as well. So, that finalizes my—concludes my presentation.

Cristine Gibney:

Hi. Thank you so much. It’s great to be here, and we really enjoyed participating in the Building Envelope Campaign. Before I jump into the AGU Building Campaign submission, I’d like to tell you

some more about our award winning design in the organization. Next slide, please.

Okay, and just move one more slide forward, please. American Geophysical Union, or AGU, is an earth space science association. Established in 1919, we just celebrated our centennial anniversary. AGU's mission is based on organizational values of excellence, integrity, respect, diversity, collaboration, and science and educational outreach. AGU's mission focuses on individual scientific endeavors and convening groups working together on discovery and solution based science. The buildings mission is the second statement. The headquarters building is a living laboratory, and AGU has opened its doors and data to provide that same discovery and solution based science. Next slide.

Who is AGU? AGU supports more than 130,000 earth and space scientists throughout the world, and even more—I'll tell you about that on our next slide.

That community expands through the many meetings, journals, and social media that AGU promotes. In fact, I would place this webinar and the Building Envelope Campaign inside these bubbles. We can't have an informed discussion about buildings without earth space science. The very weather file used to calculate the envelope performance was likely developed by AGU members. The great thing about the inclusivity of AGU is that we building scientists and enthusiasts are welcome to share in the discovery and solution based science through the AGU headquarters building. Next slide.

The AGU building is a retrofit. Several years ago, the 1994 constructed original buildings mechanical system began to fail, and our board explored three main options. First, AGU could move. Second, we could raise the building and construct a new one. Or third, do a renovation and strive for net zero. This option aligned with AGU's values, which you can also see weaved into the building project goals. This was developed during a charrette to chart the course of Washington, D.C. first net zero energy commercial building. The project is working towards an annual EUI of 13,000 BTU per square foot. To provide context, the old building had an EUI of 63. The national median for commercial buildings rounds to an EUI of 53. The Advanced Energy Design Guide recommends an EUI target of 21.7 in our climate zone. Next slide.

If you follow energy policy, you probably know that Washington, D.C. has some of the most progressive initiatives in our country. Remember that our design phase started about six or seven years ago, and I wanted to show you this graphic so you can see the dense urban environment that AGU is located in. AGU is in the Dupont Circle neighborhood of D.C. at the tip of the yellow arrow. Next slide.

Here's a close-up of the site. The current retrofit sits on the same site as what we often refer to as the old building, and in fact, 96 percent of the building shell was reused. The envelope was enhanced through insulation and new windows. There are only a few outside changes to the building in a few key places, most notably the glazing at the front of the building that we call the prow. You can see the old prow in the picture in the upper right-hand corner. If you look at the picture in the lower left corner, you'll see the southern elevation or, more accurately, you won't see it because the entire elevation is buffered by a neighboring building, 2001 S Street, at the lower part of the red site line on the map. This is one of two main features that opens up the possibility for such a tall building to attempt an EUI of 13. Next slide.

This is a rendering of the new building. AGU's staff occupied the building in April, 2019. As I speak, the construction team is finishing the photovoltaic installation in our plaza area. In both pictures, you see the new, expanded prow. The thing I love about the prow from an architectural standpoint is that the building really becomes the embodiment of AGU science and values. Some people think it looks like a ship, some people think it looks like a spacecraft. No matter what you see, you get the feeling of discovery and excitement about the future. The lighter bands are a frieze with artwork depicting AGU scientific domain.

One of the things we learned when studying the original building is that they were uninsulated. This was fixed during the renovation. Additionally, studs were added to the interior perimeter walls and filled with eight inches of closed-cell spray insulation, leading to a 15.7 R value. The original building's R value was 6, and the main insulation came from four inch batt. Next slide.

Here's a quick overview of the AGU building. This seven story building houses a state of the art conference center, museum quality science displays, and a members' lounge on the ground floor with supporting conference areas on the lower level. There is a tenant space on the second and part of the third floor. The AGU staff occupies the upper three floors, and then there's a green roof

under the PV, and one of my favorite places of all, a deck for the staff and conference rental space with a view of the Washington Monument. Next slide.

AGU hosts tours, net zero tours inviting the public to see our building in person. In our first year of occupancy, we hosted over 1,700 people, from school children to professionals, to see high performance close up. Once the COVID-19 pandemic is at bay, we will open up our doors again and hope to see you in person. I'll reference tour spots on my presentation, but there's nothing like seeing it firsthand. And I mentioned also that our southern elevation was a game changer, but there's another spoiler alert that I'm gonna tell you in a few minutes.

Right now, one of the things that you'll see on our tour that's actually on a wall that we have as we start the tour is the high performance design. AGU looked at over 50 high performance strategies and used about half of them to realize the high performance design developed by our Integrated Building Team to achieve that zero energy. The first three principles focus on lowering demand—reduction, reclamation, absorption which enable generation, which is estimated at 332 megawatt hours annually from the PV to achieve the EUI of 13 that I mentioned earlier.

I will predominantly stick to strategies directly related to the envelope, which are found in the reduction principle, and they're highlighted on the slide in green. If you're interests are sparked, there's links on the final few slides about a USGBC case study and a fantastic webinar case study recorded by Interface Engineering, which is the AGU project design engineers that lay out the main features in detail.

One of the challenges of explaining these strategies in pieces is that each design feature depends on other features. Interestingly, much like Hayley was talking about in her part, when we give in-person tours, it's so easy to forget about the envelope because we're looking at mechanical rooms or lighting or other things with signs. Net zero energy would not be possible without the R15 walls and the R30 roof. The triple pane windows and associated assemblies have a 0.23 U value, contributing to this tight envelope. I'll go into some detail in a minute about the dynamic glass shading. Thanks to that envelope and a little help from people, plugs, lights, and solar heat gain, the building requires minimal heating. Of course, with the tight envelope, ventilation is carefully

designed. In fact, we have a DOAS tied to a hydroponic phytoremediation wall and an air quality monitor.

Other unusual features are DC powered lights and workstations, storm water reuse, radiant cooling, and our municipal waste water system. Let's talk about that on the next slide.

You may have never heard of municipal waste water systems, because our insulation was among the first in the United States. Believe it or not, we don't have a cooling tower, because the sewer essentially fills that role. A more than 100-year-old sewer line runs along the street outside AGU's building. AGU's municipal sewer heat exchange system taps into the sewer line and diverts waste water into a special well. The water then moves inside the building into an exchange system that absorbs energy from the water before it returns to the sewer. The energy exchanged allows AGU to transfer the heat from the building into the sewer and vice versa, allowing building temperatures to cool without relying on the building chiller. This is in the "seeing is believing" category. Next slide.

SageGlass was a fantastic partner on this project, and you can see the specs we used. The building fenestration is made up of triple pane, air filled, 1-3/4 inch dynamic glass windows utilizing an electrochromic film for on demand tinting. There are four tinting levels detailed at the bottom of the slide with their respective solar heat gain coefficients. I modeled the lightest tint and darkest tint as part of the envelope campaigns separately for comparison. The tinting changes throughout the day to optimize the solar gains for heating and cooling demand through a program based on the sun path paired with sensors on the side of the building making real time adjustments for cloud days.

You may also notice that there are no blinds in this picture. The added benefit from an operational perspective is that you don't have to install blinds, you don't have to clean blinds, you don't have to maintain blinds. And the thing that many people forget is that, with blinds, there's still some heat radiated into the building. Sage windows block unwanted heat gain, supporting other net zero components during the cooling season. Next slide.

Here are some other graphics to help you understand the window system and components. The operational tinting is controlled by monthly window zones, and then each individual window is then programmed with a zone. Most windows are managed through programming during the commissioning by the manufacturer. Our

conference rooms also have overrides that enable presentations at the darkest tint and can be adjusted using the SageGlass switch as require. Next slide.

The electrochromic windows help control radiant heat gains and complement the radiant cooling system, enabling a set point of 78 degrees inside while complying with ASHRAE thermal comfort zone. In fact, we had a brownout during one of the hot days in 2019 and we ended up tinting the whole building to the darkest 0.08 solar heat gain coefficient tint, and I was really impressed at how well this combination of tight envelope and tinted windows worked while Pepco stabilized their grid. Next slide.

This is the prow from the inside, and it's so stunning that even this picture doesn't do it justice. During the campaign, we had to do some calculations for this part of the building. So, I want to point out, the left side of the picture is north facing, and then the windows to the right are east facing. The other thing this picture helps you see is density, and also, notice that the building to the north, that's on the left side, normally you'd assume that north facing windows wouldn't need tinting. But take a look at the glazing on the building across the street. We had to adjust the window programming not just from direct sun, but also from the glare from our neighbors. Next slide.

I'm gonna show you a few pictures so you can admire the building. This is an inside view right outside of the prow, and we've got a monumental staircase, some breathtaking graphics celebrating earth space science. The theme on this floor is space. Next slide.

And here's a typical space for our AGU staff, and then—next slide.

And then here's our staff kitchen. There's another shot of parts of the prow and I just think it's a beautiful space. Next slide, please.

After showing you some of the beauty, let's get back to the brains of the project. We're collecting and sharing data to help other high performing buildings. AGU is committed to identifying and sharing best practices for commercial buildings that want to reduce their carbon and environmental footprint. We will track our building system metrics and we will make the data and experiences open and available to researchers, academia, builders, engineers, architects, and pretty much anybody else who wants to take a look at it. Next slide.

And a little bragging. In January, 2019, at AGU's headquarters, D.C. Mayor Muriel Bowser signed clean energy legislation into law. The landmark Clean Energy Bill established Washington, D.C. as a global leader in clean energy to combat climate change. The ceremony was hosted at AGU headquarters as an example of meeting energy goals in combating climate change.

And one more. In 2019, AGU was included in a distinguished class of honorees—oh, I'm sorry, next slide—hosted by the Department of Energy and Environment when we received the very first Clean Energy D.C. Award to honor AGU's commitment to sustainability through our newly renovated headquarters building. AGU Building is often considered the flagship example of Clean Energy D.C. Next slide.

And the very reason I'm here—every voice matters, and we want to learn, lead from the front while supporting great programs like the Building Envelope Campaign. High performance buildings can be beautiful, support values and effectiveness while attracting talent. Next slide.

Now, let's talk about the AGU experience with the Building Envelope Campaign. It was a fantastic program run by the helpful folks from Oak Ridge National Laboratory. I did entries for AGU and want to share our approach and the results to help others join us in the campaign. From my view, there are four easy steps to submission—join as a participant, gather the information, calculation, and submit. Next slide.

Like many things in life, deciding to join may be the most difficult thing. The team at Oak Ridge National Labs make it super easy. For step one, I followed the website instructions and received a log-in and password in minutes. When I initially went to the platform and noticed the geometry on the building, I began to worry that AGU's unusual geometry wouldn't work. But no worries, Hayley sent me a request teams to discuss AGU's submission. I told her about the unique geometry of the project as well as the electrochromic windows. A few days later after a short meeting, my concerns dissolved, and we were ready for the next step. Next slide.

Step two is gathering the information. To help this part of the process, I established a data sheet to record the requirements by snipping each grouping of submission requirements and establishing a log of the AGU entries by four columns. One is category, two is values or the actual entry into the Building

Envelope Campaign tool, authoritative documents, and then finally any assumptions that I used to come to the value. And I maintain this so that anybody else that looks at how we've entered the data will be able to understand what we did. Next slide.

We had most of the information in three documents. I pulled the most information from our energy model, which we commissioned in pursuit of our net zero energy goals. Then construction documents complemented the energy model and I used the BOMA Guide from Hickok Cole Architects to get my condition four numbers. Next slide.

When it came to total surface area for the walls and windows, we had to go back to our architects. And I owe a shout out to Gil from Hickok Cole, as he delivered them in lightning speed. He listed the prow area as Northeast, and you can see, I took those values and I assigned half to the north and half to the south, which is just almost exactly what Simon was talking about in his presentation. Next slide.

And once you get to step three, calculations get easier, you just enter the data. Next slide.

When I entered the values, I did adjust the cooling set point due to the effects from our radiant cooling. We also used the default values for airtightness as we didn't have a blower door test on the original building. Next slide.

Once I answered the data, I ran the tool. It was really quick and I ran one for each solar heat gain coefficient. So, you can see on the slide, I've got the lighter one on the left which was a solar heat gain coefficient of 0.37 and then the darker is the 0.08. Next slide.

And probably the easiest thing is submission, because really, all you have to do is push the blue button and go through the steps that Simon showed you. Next slide.

As part of the final results, you receive a breakdown for the wall, window, roof, and airtightness—all of the things that Simon just told you about. And here's our blowup of the solar heat gain graphics for both. You know, as I looked at the results, I was a little surprised, because D.C. is in climate zone 4 alpha, which tends to be more cooling dominant than heating, but it also tracked with the fact that I'd done some other EnergyPlus models on other buildings and it really demonstrates how climate orientation and load are worth modeling, because it's the best way to really

understand performance, which can sometimes be counter-intuitive. And that's another reason why it's so great to have folks from the labs to kinda help talk to you about it and make sure that what you're doing is right. Next slide.

Alright, and I want to thank the team from Oak Ridge National Labs—you made a fantastic tool, and more important, you really made it easier for owners to join your campaign. Thank you so much.

Hayley McLeod:

Thank you so much, Cristine, and thank you for telling us all about your building. As soon as we can travel again and I can come to D.C., I will be taking you up on a tour.

So, just a reminder to everyone that we have been accepting Q&As in Slido, but we do have one final poll for you. This one's gonna look a little bit different. We are actually doing it in not Zoom, not Teams—this is GoToMeeting, there we go, we're doing it in GoToMeeting, because we do want your contact information. So, this should be popping up now and so, we just want to know if you're likely to join the Building Envelope Campaign. There's a yes as a supporter, as yes as a participant. If you need more information, that's totally fine, I hope you reach out and get that information from us or not at this time. So, again, we just went ahead and dead this one in GoToMeeting so that we could reach out to you specifically if you said you were interested in joining.

So, I will leave this up for a few minutes so that you guys can answer, and then we will go over to Slido and answer—so, we've had a few questions come in for Q&A. And one more reminder about Slido is that you can go in and thumbs up things so that if we run out of time, we can make sure that we answer those most popular questions.

I can't see the responses come in. I'm sure I can, but I'm not sure how, so I'll leave that up for a little while longer, and then we can go over to Slido.

Okay, well, I'm gonna start—there we go. Okay, so, I think in just a moment some questions will pop up on the screen here and we can jump into that. Yeah, I gotta serve, kind of, as moderator, and I will share these questions as we go.

So, the first question is, “How does this tool integrate, if at all, with EnergyPlus?” And I figure I can answer that and then Simon can chime in. It's that it does not integrate with EnergyPlus, but

that it was validated against EnergyPlus, but this tool is hard coded and is running its own calculations. So, does that cover it, Simon?

Simon Pallin: Yes.

Hayley McLeod: Perfect. “For the airtightness metric, what is the pressure that the air leakage is based on?” Simon?

Simon Pallin: 75 Pascal.

Hayley McLeod: Love it—super quick. Next, “How does exterior shading figure into the program? I find this is not often considered and/or is entirely overlooked and can have a huge impact on energy use.” So, that’s another Simon question.

Simon Pallin: Yeah, and I think we had some participant that had that kind of shading system and attachment—window attachment. And if we can’t use the tool, then we’ll have to use something else. Sometimes, it’s possible to play around with the solar heat gain coefficient to sort of get the sort of same result. But if a shading system has been installed, I think we would take a look at it separately.

Hayley McLeod: Great, thank you. And then it looks like we have two back to back questions for Cristine, but real quick, in case this person has to sign off, where do you go to obtain the tool that is gonna be included in the slide deck and stuff, but it is ec.ornl.gov, and you can request log-in information there, but that will go out in all the slide decks.

So—question about AGU. “Why was air used instead of argon gas for the windows?”

Cristine Gibney: I may ask Simon for an assist on this, because you know, I know we modeled—there was a lot of modeling involved in our building. So, it was selected because it had the right qualities. I don’t know if Simon’s got some speculation as to why it would have been that way.

Simon Pallin: Actually, I don’t. I think it’s a great question. Sometimes, it’s just a balance between how much—in some climates, it’s actually beneficial to have a high solar heat gain coefficient versus low, and sometimes it’s beneficial to have a high conductivity.

So, but I don’t have a good answer for that. I don’t actually know. I think that’s a good question.

Cristine Gibney: I'm gonna have to research it.

Hayley McLeod: I was gonna say, you stumped the chumps—this is great.

Cristine Gibney: [Laughter]

Hayley McLeod: Anybody else remember *Car Talk*? Anyway. Okay, next question for Cristine, “For AGU, considering the renovation costs that can be accounted to building envelope energy savings, have you all performed a financial analysis and what were the approximate results, simple payback or other?”

Cristine Gibney: So, as I mentioned, we're still finishing up our PV, so we're not 100 percent finished, and then we have to go through our commissioning. So, right now, we don't have the actual numbers, but eventually, we will share that once everything's said and done.

We did see some really unusual things on our project that don't always translate from a financial standpoint, because, actually, one of the things that we did do, as I mentioned, we reused 96 percent of our building shell. Also, there were a few places where we removed those bricks. We reinserted them and we had somebody actually clean them, because we didn't want them in the landfill. So, we often did a lot of things to lower our footprint, basically, at any cost.

Hayley McLeod: Alright, thank you. “Would it be possible to join from Japan and input climate data from here?” Unfortunately, the tool really has been optimized right now for the U.S. It's based on U.S. climate zones, U.S. codes, U.S. DOE prototype building. So, if you had a particular building that you wanted to maybe assess with the tool, if you reached out to us, we could maybe help you tweak that on a particular building and, you know, maybe in a future iteration of the tool. But for now, it is focused on the U.S.

The next question is, “I'm still on previous steps. I need to know if my manufacturing buildings have opportunities in your program. What should I do to get your help for an initial assessment to look for opportunities?”

I think your manufacturing buildings could possibly have opportunities in our program. I can't—it looks like Simon might have dropped off, but I think there might be a DOE prototype that would fit. And so, if you—oh, nope, there's Simon. But you could just reach out to one of us after we get off of this webinar and we

can answer it. It sounds like you have a very specific building in mind, and so we can engage on your particular building.

And then it looks like the last question and then I have a few summary slides. “Is there any back end reference component list with properties documentation? I remember there was a document a few years ago that listed lots of common envelope constructions and their actual U values and such. Thanks.”

So, if you actually jump into the Building Envelope Assessment Tool, there is an R value calculator on the side. There is a bunch of help information embedded in the tool and then, after you run a Building Assessment, and actually even if you don’t, you can still access it, we do have a nice library of resources collected on the website, but not necessarily just a large—at least that I’m aware of, we aren’t necessarily just linked to a large table that would answer your U values and R values and that kind of thing.

Does that sound about right, Simon?

Simon Pallin:

Yes, it does.

Hayley McLeod:

Okay. I think we probably are gonna have to jump on over to our summary slides from Better Buildings. I believe that the slides do go out indeed. Let me see if there’s—well, I can still see Slido on my end. Yeah, I’m sorry, it looks like one or two folks are coming in and I think we’re out of time. I do encourage you to e-mail us if you have a particular question, and we will try to get that answered for you. So, next slide, please.

So, these are a few additional resources that Cristine has provided. So, again, this will go out in your deck, and so those are all links that you can link out to. Next slide, please.

As mentioned, this is part of the 2020-2021 webinar series, and so, we have a great lineup of presentations through April, and you can register on the Better Buildings Solution Center. Next slide, please.

So, the next one of these won’t be until after the holidays, it is January 12th, and it is for a webinar entitled Beyond Energy Savings: Quantifying the Additional Benefits from Energy Efficiency, and you can join this webinar to learn about a new methodology to quantify the non-energy savings and revenues for energy efficient projects. So, a nice tie-in with some of the questions Cristine was getting. Next slide.

We also encourage you to visit the new Workforce Development Portal. You can take the next step toward a career in energy efficiency and get resources, information, training, education, and job opportunities all here. Next slide, please.

To watch recordings from the Better Buildings Virtual Summit, the 2020 summer webinar series or technical presentations from the National Labs, please visit the on-demand webinars library where all previously recorded presentations are archived. Next slide, please.

This is the Better Buildings Solutions Center, I think, is the next slide that will be coming up—there we go—where you can find one of our 2,500 publicly available solutions. You can explore by topic, solution type, or go to one of our program and partner pages directly. Here's where you can find our Technology Campaigns tab filled with various resources, including where to find our Building Envelope Campaign and more information. Go to energy.gov/bbsc to explore all the Better Buildings Solution Center has to offer. Next slide, please.

Okay, and so, this is our close. I would like to thank Simon and Cristine for joining me today. Feel free to contact us directly. You can see all of our contact information there. So, yeah, for those couple of questions that I didn't get right at the end there, please feel free to reach out to us directly. And I also encourage you to follow the Better Buildings Initiative on Twitter for all the latest news, and you will receive an e-mail notice when the archive of this session is available on the Better Buildings Solution Center.

So, thank you, everyone, and have a lovely afternoon.

Simon Pallin: Thank you, everyone.

Cristine Gibney: Thank you.

[End of Audio]