

Anthony Aldykiewicz: So, welcome everyone. We're going to begin the webinar in a minute or so.

All right, so I think I can start. So hello and welcome to the Building Envelope Campaign Webinar Series. In this series, we share technical assistance and recognition opportunities through four of the Department of Energy's technology campaigns: the Building Envelope Campaign, the Efficient and Healthy Schools Campaign, the Integrated Lighting Campaign and the upcoming Storm Window and Insulating Panel Campaign. It highlights engagement and recognition opportunities and features campaign participants sharing practical approaches to improving energy efficiency.

So before we get started, there are just a few housekeeping points I'd like to share. Just note that today's webinar will be recorded and archived on Better Buildings Solution Center, so we will follow up when today's recording slides are available. Next, as attendees, you are in listen only mode, so that means your microphones are muted, so if you are having any audio or visual issues throughout the webinar, please send a message via the Q&A box which is located on the bottom of your Zoom panel and then we'll try to help you. So next slide.

So my name is Anthony Aldykiewicz and I'm going to be your moderator for today. I am a senior R&D member at Oak Ridge National Lab and part of the Building Envelope Materials Research Group. Next slide.

So here is the agenda for today. So today, you're going to hear from multiple DOE technology campaigns. I'm going to start us off by talking to you about the hosts of this webinar series, the Building Envelope Campaign, and many of you were here from the Integrated Lighting Campaign and then we'll end with the Efficient and Healthy Schools Campaign before we close for a brief Q&A session. So, we can go to the next slide.

So, the Building Envelope Campaign, next slide. So, before I continue, what I want to do is recognize the organizers of our campaigns and those are The American Institute of Architects, the International Facility Management Association, and the International Institute of Building Enclosure Consultants. So without their support, a lot of what I'll be talking about wouldn't have been possible. So really appreciate their participation as organizers. So the next slide, please.

So how to assess the overall building envelope performance? That's the challenge that we face. So unlike energy loads from equipment and lighting, directly measuring overall performance of the building envelope is impossible. We can measure leakage, but we can't directly measure the overall performance, considering all the other elements that make up the envelope. So to simplify things a bit, what we did is develop a metric or measure that accounts for the performance of the envelope holistically, so accounting for the walls, the roof, fenestrations, air leakage and external loads, which are dependent on climate. So next slide.

So as a result, what we did is we developed the Building Envelope Performance or BEP metric. And in this case, the heating and cooling loads are equivalent to the building envelope energy loads plus any internal loads. So like whole building energy calculations, the Building Envelope Performance metric has units of kBtus per square foot. The difference is that it's based on the surface area of the building envelope, not the area of conditioned floor space. And what's neat about this approach is that all the user needs to know is location, building type, wall area, window area, the air leakage, if they can measure it, and the value, the insulation value of the opaque portions of the wall. So next slide.

So having developed this approach, the goal for us was now to get it in the hands of practitioners, so hence the genesis of the Building Envelope Campaign. Under the auspices of the Better Buildings Technology Campaign, the Building Envelope Campaign was launched. So the intent was simple and that's really to help practitioners design more energy efficient buildings by introducing a new assessment tool that's easy to use compared to whole building energy calculations.

And what this does is provide users a simple and quick way to easily assess different building envelope options. It also gives users guidance with respect to what part of the envelope has the biggest impact on performance. So the Building Envelope Campaign provides targeted guidance with respect to what part of the envelope would benefit from most energy improvements, such as additional insulation, more thermally resistant windows and/or reduced air leakage. In addition, what the Building Envelope Campaign provides or points users to are resources that are meant to help with respect to design, you know by material systems and case studies. Next slide.

So, our goals are simple, and that's to motivate action and increase awareness, recognize those leaders in building envelope design and

demonstrate and document performance. So really, it's to help those realize the benefits of investing in building envelope performance improvements whether new construction or retrofits, to recognize those that are leading the effort to design more energy efficient, sustainable buildings, and to communicate those benefits by quantifying energy and cost savings as results from design construction commissioning and maintenance of high performing building envelope systems. So next slide.

So how do we get there? So there are a couple of ways to benefit from the Building Envelope Campaign and that's as a supporter or as a participant. As a supporter, you'll have access to the people and resources that make up the Building Envelope Campaign. You can partner with team members to help promote benefits of the campaign and in addition, there's recognition as a supporter as well as access to other supporters and participants of the campaign.

So those would be the benefits of the supporter participants. They're the ones that are actually using the tool in their projects. So as the participant, you'll have access to the technical experts' resources and lastly, the recognition piece. So as far as technical experts and resources, we're here available to you to provide you guidance in helping you select or design your building envelope system. The recognition part, that comes in the form of awards and/or participating in case studies. And just a quick note, this last bullet here, I wanted to let folks know that if there's a project that's been completed since January of 2019 and that you feel the improvements made are worth recognition, you can register and submit your project to the campaign. So it's not late to do that.

So, let's now just – so next slide please. So let's talk a little bit about recognition for the campaign. So, recognition comes in two forms, two categories and each category has two tiers. So there's a retrofit category and a new construction category. So, for retrofit, you have a Retro 30 and Retro 50. And what these numbers represent are basically improvements in performance with respect to the base case. So in this case, it would be your initial construction with no retrofit improvement. And so that's basically what it is. It's 30 percent over the base case or 50 percent over the base case.

For new construction, we have Novel 20 and Novel 40 and here the performance improvement in this case is relative to code compliant buildings and we're using ASHRAE 90.1-2016 as our standard, so a Novel 20 would be a 20 percent improvement over that code compliant building. And we also recognize those efforts

that are focused on building envelope improvements in underserved communities and serve as role models for the rest of the industry. So we do make an effort to recognize that effort.

And lastly, we want to recognize those designs that don't meet the criteria for an award, but make an impact or a difference that merits recognition and raising awareness to the rest of the building community. The goal is to try to build best practices. Next slide.

So here's a bit of history regarding the campaign. So the campaign was launched in 2020 just about the time when the country started shutting down for COVID. Fortunately we're now in our second year and looking for continued participation. The campaign remains open to both participants and supporters and I encourage those of you that are interested to sign up. It's very easy to do. And we continue to accept and review submittals from participants, and as I mentioned earlier, that projects completed since January of 2019 are eligible for submission. The submission deadline is April 8 of this year and so we hope to hold, based on how reviews go and how many submissions that we have, as a recognition or award ceremony in the summer or fall of this year.

So that's the goal. The neat thing about this is that there's no obligation to join. The campaign is free and if you are a supporter and you do have a project that you're interested in switching or evaluating, then switching over as a participant is very easy to do. And if you have a trouble with that, just reach out to us and let us know and we can help you with that. Next slide.

So, now what I want to do is just let you know how we did in the first year. So, we had a total of 16 buildings submitted for review. Fourteen of those are constructions or improvements were eligible for recognition. Of those buildings, three of them were educational projects. In total, the buildings accounted for just over 1.5 million square feet of conditions space. The net savings annually was about nine million kBTUs, and that was based on just the building envelope improvements alone, so that was pretty neat.

We have a wide representation of building types. We also have representation across different sectors in health care, education, commercial, and industrial. Building size ranged from 50,000 square feet to about 500,000 square feet, so it was a good representation of buildings. Next slide.

So what I'll do now is just quickly cover some of the awards that we're giving. So this is under the category of retrofit, so the B246

apartment building that's located in Virginia and some of the notable improvements that they made to achieve 30 percent reduction in _____ rather was by installing Low E storm windows in that case.

The Retro 50 award, three examples of Retro 50 awards, I'm going to just highlight American Geophysical Union building, which is the picture on the right. That building is located in Washington D.C. This building is a net zero energy building, so they easily achieved Retro 50. And one of the improvements they made, which I wanted to highlight, was the use of chromic windows. So chromic windows, I don't know if you're familiar with them, if you notice, if you have glasses that have transition lenses, it basically changes color. They dynamically transition between clean and dark, clear and dark, rather, and so that will impact the solar loads or solar heat gains that the building sees internally, and so that's one neat technology that was used to help them realize Retro 50. So, next slide.

So in new construction projects, here are some examples of projects that achieve Novel 20 and 40 awards. The projects highlighted in green also represent academic buildings. I will comment on one and that's the Boulder Valley School District Education Center. So this project was part of a \$677 million countywide initiative to improve energy performance of all of the academic buildings in the county including construction of new buildings.

This project achieved Novel 40 which is 40 percent improvement in energy performance over a code compliant building, and they did it by addressing a host of issues. So they addressed daylighting. They increased the level of roof and wall insulation. I think that was almost by a factor of two.

And then they also reduced air leakage by implementation of an air barrier system and when they measured performance, their air leakage was reduced by just almost 30 percent I think compared to code. So I thought that was a pretty neat story.

If you want to learn more about this project, I would point you to a YouTube video, Jeff Medwetz, he's a project manager of energy systems for the Boulder County School District, he put together a really nice five minute video describing the project and you can find that video on YouTube. And if you have trouble, just give me a shout and I'll point you to the link, but all you need to do is just search for Building Envelope Campaign and you'll find it and then

throw in the Boulder Valley School District and you'll see it. He did a really nice job. I encourage you to take a look at it. Next slide.

So with that, I'm going to hand it over to Hannah Carter. She's a participant in the Building Envelope Campaign and so I'll let her introduce herself and talk to you about her project. So Hannah, it's all yours.

Hannah Carter:

Thanks, Anthony. We can go to the next slide.

So my name is Hannah Carter and I am the Sustainability Coordinator at Parkway School District and I'm going to be talking about our participation in the Building Envelope Campaign. Next slide.

So, a little bit about our school district. We're a public school district located in St. Louis, Missouri, so about 20 minutes outside of the city with approximately 18,000 students, around 2,000 staff. We have around 34 buildings comprising 3.5 million square feet. Our school district has set a number of sustainability goals which has tied us into some of these other campaigns with Better Buildings and one of those being the Better Buildings Challenge, which is where we first learned about the Building Envelope Campaign. And through the Better Buildings Challenge, we have set a goal for 35 percent energy reduction by 2025. That was our second goal after we met our first goal of a 20 percent energy reduction.

Some other programs that we've participated in are the US Department of Education Green Ribbon Schools, so we're a Green Ribbon district. And we were also awarded the Energy Star Partner of the Year award in 2021. So all of this work around sustainability and saving energy has been integrated into our school district culture for a long time and it has a direct tie into our district strategic plan. I have that quote there, to integrate environmentally, socially, and fiscally sustainable best practices into every department. So just a little background there.

Next slide. So more into our strategies around energy savings at the school district. We have created sustainability and energy related board policies and administrative procedures to help guide our work through the district and solidify it long term. Something I'm going to be touching on here more is our capital replacement and building design processes including implementing the ASHRAE 50 percent advanced energy design guidelines into our specification.

We do a lot of retrofits, so everything from lighting, envelope, water, savings, because we don't build a lot of new buildings, so for the most part we're just looking to retrofit our older existing buildings that we do have. We've implemented a lot of energy savings strategies into our purchasing policies, so Energy Star equipment, trying not to buy one for one equipment, getting something that is more energy efficient if possible every time that we're moving toward and purchasing.

We do a lot of behavior change campaigns with students and staff, competitions throughout the school districts, staff training, professional development, teaching students about our energy systems that we have, whether that's our renewable energy, solar arrays, our geothermal heat pump systems, all of that, so that they can really get that sense of how are we making a difference every day and how can they get involved in it in real world applications.

And then part of my role is heavy on the monitoring and analysis side, so using our building automation system to monitor our HVAC system, same thing with our fault detection software, really trying to optimize and fine tune where we can, and then benchmarking all of our utility data and doing retro commissioning projects on our buildings as we can. Next slide.

So, more about how we joined the Building Envelope Campaign. As I said, we learned about the Building Envelope Campaign from through the Better Buildings Summit last year, and being partners with that, we knew that Better Buildings Campaigns are great and a great source of resources and so when we learned about the different information needed to go into the Building Envelope Campaign, I immediately thought about our specs that we've integrated, the ASHRAE 50 percent Advanced Energy Design Guidelines into our master district specifications and every summer, we typically have at least one school that needs a new roof, half a new roof, whatever the portion is.

And through those specifications, all of our roof replacements have been going to R-30 roof from the existing R-8, so a substantial improvement to the insulative value of our roofs. And so this data we've been collecting, it was easy for us to collect this data 'cause we were already submitting it for utility rebates, which I would encourage if you're participating in the Building Envelope Campaign, you can probably show your energy savings to your utility and potentially get some rebates there if you have a similar program in your area.

So all of this data was handy for that reason. Off to the right, there's kind of a screenshot of the ASHRAE advanced Energy Design Guidelines that I keep talking about. We also strive towards their Net Zero energy guidelines. And down on the bottom right is a phot of one of our elementary schools that this upcoming year, we hope to also include in the Building Envelope Campaign. This is a school with a lot of solar, but they're getting a lot of new roofing as well. And then just kind of showing in the bottom, that's the screenshot from the ASHRAE Advanced Energy Design Guidelines recommending R-30 roofing insulative value. Next slide.

So some of the reasons that we decided to join the campaign are the wide array of benefits to participants. So first off, being recognized for this work, it allows us to do more of the work. So when we get recognized for this, we gain a lot of support internally from our administration, our board of education and even our community that votes for our bond issues that we pass that help fund these projects and keep more energy efficiency projects rolling. It also allows us to share out story with other schools locally and nationally and get more people on board and it will be great to be able to create a fact sheet and a video with Anthony and his team that can promote and share our projects.

Another big benefit to participating in the Building Envelope Campaign is that when you're making improvements to your building envelope, you're doing a lot of energy reductions, like we talked about, but including in that you're often improving your indoor air quality and improving occupant comfort, which for schools, all the time but especially right now, is super important.

We've also found that when we're coupling our roof replacement with more insulative energy efficient roofing, we're often able to downsize our HVAC equipment because our thermal load has been reduced by the extra insulation. More cost savings are that by showing these energy savings, we're often able to get utility rebates. So for the three projects that we submitted this year, we expect to get \$16,000.00 back in utility rebates alone and then we use these rebates to then do more energy efficiency projects kind of in a revolving fund. More reasons to participate are just the support from the team and the easy to use tools in this program.

So the tools, once you have the data to plug into the tools about your building, I think it took me maybe ten minutes to get the screenshot you kind of see below, the percent improvement on one

of our buildings, so super easy to use, and then any time you have questions, the team is very supportive and can help give you suggestions on more ways to improve and any data that you need. So that's all I had. Next slide.

Axel Pearson:

Okay. I'm up. Thanks, Hannah.

Hi everyone. Thanks for having me. I'm going to talk a little bit about the integrated lighting campaign. My name is Axel Pearson. I work at Pacific Northwest National Laboratory. So I'm going to give you just a quick five minute overview of the campaign. It's really not too much different in structure and goals than Anthony talked about with the Building Envelope Campaign, but this one is focused on lighting. So if I pique your interest today, we have a couple webinars coming up in the next month or so where I'll go into much more detail. So if you're interested in that, shoot me an e-mail for more information. My contact info I think will be displayed at the end of the webinar. Okay, next slide. Oh, let's go one more.

Okay, so just like the name sounds, the Integrated Lighting Campaign focuses on not only lighting but integrated lighting, and that means that the lighting system can communicate with other building systems to enhance building performance. But that's not all the campaign is interested in. There are still luminaires and luminaire systems lighting systems that we're hoping to capture as well. And that's like advanced systems and controls and lighting that really improve lighting performance. We're definitely interested in that so we'd love to hear how systems are going above and beyond things like simple occupancy sensors or daylighting or scheduling, so any of those really innovative approaches.

But back to integrated lighting, so really today's lighting can communicate with other building systems to achieve deeper energy savings within the building for example, by exchanging information with the HVAC system or controllable loads. And while the integrated systems energy benefits often result in a favorable ROI, there are some non-energy benefits associated with integrated lighting that really may tap into a higher value proposition that can further tip the scale in favor of adopting these systems.

An example of non-energy benefits is space utilization and such analyses that kind of leverage the occupancy sensors that are already there for the lighting system. This can give you information on space optimization and layouts. In a school, this

might be helpful in identifying if certain classrooms are more occupied than others or maybe a common area that are used inconsistently so you can get people to use and spread out the building and use it more efficiently. Maybe a corridor is more crowded than others and you can kind of change rooms around and reroute students. Could be helpful with space efficiency, but also like social distance planning. Right?

We want folk maybe not to be as close as they possibly can, but use the space in the school. Another example might be asset tracking, which is a common feature with some of these integrated systems, and that can help located equipment like the laptop cart in your school or something like that.

So anyway, through the ILC, we hope to learn and recognize some of these innovative lighting projects and I think schools are a pretty good candidate for these types of systems, so really be interested to see some schools come through with this campaign as they did for the Building Envelope Campaign. Next slide.

So there's some resources on our website, things like reports, case studies, case studies from the research labs, other third party organizations, utility incentives. They can help provide financial support for those taking on these advanced lighting projects. Webinars or trainings are also listed on there along with topic relevant videos. So I encourage you to check out our website when you get a chance. That'd be great. Next slide.

Okay, so this is really about recognition and this is the main goal of the program. So, we want to recognize those innovative, advanced lighting projects and they're kind of based on these six major categories, two of which on the right hand side are new. So starting on the left, there's the advanced use of sensors and controls for lighting, like connected lighting systems and networked lighting controls. Then there's integrated controls for plug loads and HVAC with those lighting systems, and that's kind of what I was talking about a little bit where lighting systems help inform those other building systems.

There's also integration with other systems, and here there's so many possibilities. The lighting system can interact with things like automated shades or solar panels on the roof to make sure that we are using the energy wisely, security systems that might use the occupancy sensors as well. Again, a ton of options there.

So with those two new recognition categories, one may not be too

useful to schools, but maybe they're doing some horticultural lighting in some classrooms, but really I think the innovative maintenance, operation, and financing models that includes different approaches to fund integrated lighting might fit well in a school and this could be lighting as a service or different utility incentives or really any alternative financing options. Okay, next slide.

All right, so if you know of a project or know someone that might be interested in being recognized by DOE, this is the form you would fill out. Basically tell your story of the project, how it fits into the recognition categories and then you just provide some supporting data, such as the number of buildings impacted, energy savings, incentives, that type of thing. Last slide is the next one.

So here's the timeline for this year, but really what happens beyond recognition is where the campaign really seeks to add value. We really try to create a body of knowledge from the recognized projects, some basic information about each project and its benefits as shared during recognition but really more in depth case studies are planned for development for some of those recognized projects. We've just published a couple on our website. Also newsletter articles is a way we can communicate about these projects throughout the year, so really, again, creating that body of knowledge and recognizing cool installations of lighting. Okay, that's my last slide. Thank you for having me again.

Rengie Chan:

Well thank you, Axel. So I'm next. So I'm a research scientist from Berkley Lab in California and I've been at the lab for about ten years. My background is in indoor air quality, building ventilation and studying the impacts to energy and human health. Next.

And today, I'm joined by two guests. One is a campaign participant, the Charleston County School District in South Carolina represented by Ron Kramps who is the Executive Director of Facility Management. And I have a second guest today. He is a campaign supporter, Whole Building Systems, presented by Dennis Knight who is a principle and CEO and you may also know Dennis from his role at ASHRAE. And Ron and Dennis are going to share with you some projects and their on the ground experiences that showcase the type of success story that we want to amplify in our campaign. Next.

I want to start by giving you an overview of the campaign. It's a little different. You heard about a technology focused campaign. This one is focused on a type of building, schools. And I'm the

campaign lead and I wanted to give you some – show you the recognition categories, so give you really a sense of our core objectives and then I'll hand the mike over to Ron and Dennis. Next.

So the Efficient and Healthy Schools Campaigns aimed to engage K-12 schools to improve energy performance and indoor air quality. And we recognize that there is an immense need to address both through HVAC and other facility improvements. This is a campaign led by the US Department of Energy with Berkley Lab assisting, we're unique in that we have two other agencies involved, the Department of Education and the US EPA. We're working together because we realize that there's a lot of existing relationships these agencies have built with schools and wanted to build upon that and align our objectives.

For example, Parkway Schools mentioned that they are also taking a role in the Green Ribbon School that's run by the Department of Education and for the US EPA, that's a long program called the IAQ Tools for Schools and our campaign is working with that program so that we are aligned. Next.

So, our campaign is just starting. It's sort of like a kindergartner and the very first step on the journey and I have a first grader and a preschooler at home so I kind of really relate to this feeling of starting a journey together. We launched in August 2021 and currently, we have 23 districts representing about 700 schools that have joined us. The campaign is providing technical assistance and resources on best practice and guidance.

We welcome all K-12 schools to join us and in our outreach, we really try to prioritize schools that are serving low income and underserved communities and also in those rural, more remote areas that are harder to reach. So aside from giving out free technical assistance from us and my background is in indoor air quality if you have an indoor air quality question come to me and at Berkley Lab, we have a team of experts in different areas. You can also get recognized for your hard work in improving energy efficiency and indoor air quality and if you're not a school but you are a state agency, an engineer, vendor, community organization, we also welcome you to join us and show your support. Next.

So we mentioned that we just launched last August and I am happy to report that we have completed the first round of recognition. Just want to show you the highlights of some of the categories that we are recognizing, really give you a flavor of the core objectives that

this campaign wants to spotlight. The first is HVAC inspection and maintenance. These are good practices that we think our schools should be doing and as we know the more upkeep that you're doing to ensure adequate ventilation and effective filtration, the more prepared you are.

Efficient HVAC, I think I heard Parkway mention – Hannah mention that when they replace equipment, they go a little step beyond. They don't do just like to like. And that's the same idea here. When you replace an HVAC system, we'll look for those technical specifications that the school district has committed to, so they're not doing like to like, but doing a step extra to improve efficiency, improve performance.

We also recognize the importance of ongoing monitoring and analytics and also a team approach to support strategic planning. It's so important that when funding is available, whether it's _____ or something else, your school district is ready for it and we recognize that in order to be strategic, you really need a whole team of collaborators, not just the facility manager, but the board, the administration really come together and support that activity.

And with that, I'm going to hand it over next to Ron who's going to share some stories from Charleston County School District.

Ron Kramps:

All right thanks very much Rengie. I'm Ron Kramps. I'm in charge of facilities management for Charleston County School District. Where students are the heart of our work and I'm going to be discussing strategies for improving energy efficiency and health in our facilities. So next slide.

Where in the world is Charleston County? There it is on the left. It's midcoastal South Carolina and on the right there is a map of the district and of course you can't read all that, but that's just to show that we're all over the county. Next slide.

And let's look at the stats. So about 88 schools, charters, and programs together with 24 other facilities such as leased and storage and admin and bus lots, etcetera. So 112 properties or campuses, about 10 million square feet and about 50,000 students. We are one of the 70 largest urban districts in the country, so we're part of the Council of the Great City Schools.

Since we're talking about energy efficiency, how's my organization doing? Well, next slide.

So here's our EUI tracker. Back in 2000, the state established a goal of a one percent reduction in energy use intensity per year in all the school districts. So you see our baseline was about 50 and there's – the yellow line is the goal of a one percent reduction, and we've achieved about 1.5, so we've done really well in reducing energy use intensity across the district. Next slide, please.

Now if there were just one topic that I could discuss, it would be this one. It would be facility asset management as a mindset because without a clear sense of ownership of facilities, they'll not be properly managed. If you see a facility that isn't properly managed or a system that's not properly managed, it's probably because no one is taking ownership. You've got to designate asset managers of all your facilities and your systems.

In my case, that's about 14 men and women who are asset managers of the various systems that I manage such as HVAC, restrooms, playgrounds, etcetera. And I expect all those individuals to understand the list of assets, the systems that they're managing, the condition, the maintenance requirements, the cost to maintain. They control the design specs for those items for new construction even and they each give me an annual status of assets presentation, me and my boss and the other leadership of my organization. And that's been very powerful, it's a very powerful concept, I think. And again, without a clear sense of ownership, facilities will not be properly managed.

But with that mindset, let's take a look at strategic framework, next slide, for energy efficiency and healthy schools. So here's some big picture items that flow from this mindset and lead to success in energy efficiency and health in our facilities. And the first is a biennial condition assessment. We do an assessment, it's really continuous, we get to every school about every two years. That leads to a long range capital maintenance plan, we call it capital maintenance or capital renewal. For us, that's about 100 projects every year worth about 50 million.

So we're continually recapitalizing our facilities. Another critical item is what I would call energy regulations or standard operating procedure that governs how we do energy conservation and what everyone's role is in energy conservation. Our program includes audits and an energy incentive program seven times a year where auditing all of our schools with a checklist and then we have a pool of about \$350,000.00 and we pay an incentive back to all the schools based on how they're doing on those checklists and it just incentivizes them to help us save energy. They use that money for

enhancing the education experience in the classroom.

Finally, I'd be a fool to not mention a roof maintenance program as an important part of any maintenance program that improves energy efficiency and healthy environments in the schools. So these are some big picture items that flow from the asset management mindset and lead to success.

Now let me mention a few other tactical items, next slide please, for day to day attention to energy efficiency starting with a good HVAC filter program and a good vendor helps. In my case it's Trident Filter Corporation and MERV 13 is achievable. I would suggest an energy contractor partnership with a control vendor. In our case, we have a controls vendor who maintains our controls and what better way to enhance energy conservation than to have that same vendor helping us manage those controls in such a way that we save energy. It's a marriage made in heaven, in my opinion.

Next, a rigorous intentional preventive maintenance program. I have a preventive maintenance shop and that's their focus. And finally, rigorous monitoring via our building automation system, that you're finding problems before the occupants do with a focus on saving energy. So these are daily tasks that support energy conservation. Next slide, please.

And finally I'd be foolish to not mention custodial support, which leads to occupant health and wellbeing in our facility. So as you might imagine, we're doing the weekly fogging and sanitizing, the backpack and rolled sprayers, handing out hand sanitizer and masks and other personal protective equipment, of course, using custodial checklists for wipe downs and cleaning restrooms and things of that nature, and an integrated pest management program, which is really important where all the occupants of a facility understand their role in keeping pests out and a health indoor environment for the school.

Now next slide. Let me highlight a few of my ESSER III projects. I mentioned a robust capital maintenance program that we have and I wanted to highlight a few projects actually that Dennis Knight is helping us with, so he'll be talking about some other projects as well, but here's our Baptist Hill High School roof and HVAC replacement.

This is a very typical capital maintenance kind of project where we're replacing a modified bitumen roof with a fluid applied system, replacing old aged RTUs with new energy efficient

equipment, achieving MERV 13 filtration. And the outcome is, of course, an improved envelope, a leak free roof, 20 year warranty, R-20 insulation, new HVAC units and more outdoor air. So a very good project. This is really just completing, we've already got about probably 50 to 60 percent of the facility done, so this completes the rest of the facility. Next slide, please.

It is our Minnie Hughes Elementary School, a very similar project to the one I just mentioned. New modified bit roof, new rooftop RTUs, MERV13 filtration, R-20 insulation roof, etcetera, so a good HVAC and roof project.

And finally, next slide, my last slide, one more ESSER III project and that's our military magnet high school HVAC replacement. So in this case, replacing existing HVAC split systems and scholar units and rooftop units with new equipment, then we'll have better filtration and upgraded outdoor air. So another good capital maintenance project.

Well, with that, that's a completion of my discussion of strategies for improving energy efficiency and health in our schools and I'll be handing the mike to Dennis Knight to talk some more about this. Thank you.

Dennis Knight:

Well thank you Ron, and thanks for the segue in. I will, before I go into my slides, just take this opportunity – well, you can go to the next slide. We'll just start there.

I've had the privilege, me and my firm, have had the privilege of working with the Charleston County School District for a little over 42 years with the current business whole building systems consultancy for the last 12 years and the pleasure to work with Ron and his team for about a decade now.

And I think what's really key is when Ron came on board at the Charleston County School District and began assembling and organizing his team, the first thing he managed I think was a paradigm shift at Charleston County Schools and that's having a facility management, facility asset management mindset. And I think that's key and as I go through some of these things, you'll understand why I say that.

We've worked with them to develop a rigorous set of design guidelines that get updated every year. We began and then that's been handed off to the controls vendor who does do the monitoring now, but we went through a portfolio-wide energy benchmarking

and identified what we called the energy hogs in the district that were then prioritized for HVAC upgrades.

We primarily focus on those MEP design for total HVAC replacement, so existing buildings. And the one thing again that I commend the district on is now for about a decade, we've been commissioning all new construction projects and now for about the last five years, we also commissioned the HVAC replacement projects.

So trying to get the facility asset management and the operational phase of building off to a good start and then lastly but not least, when Ron came on board, he looked at all of the consultants, including myself, and told us, look, if we're going to do design work for the school district and if we're going to do HVAC replacements, he intends for the indoor air quality in the existing buildings when we're finished to be equal to or better than new construction that's being built to current standards and codes. And so that's been our marching orders now for well over a decade and I think you can see that by some of the performance metrics that he provided there. Next slide.

So I'm going to talk specifically about St. Johns High School. It's very similar to the three schools Ron showed that we did replacements for, but we again want to improve the energy efficiency and indoor air quality in the schools. One thing you'll notice in the southeast a lot is we are air based or air cooled DX applications for the most part, but most of it's heat pumps, so that's helping with our electrification initiatives that the DOE talks about and also moving us toward decarbonization as we decarbonize the grid and are able to take some load off with heat pump technology. We replace end of life equipment with super-efficient units. So we typically strive for something that started out at about an EER of 8 and get our Sears and EERs into the 14 and 16 range.

So one thing that allows us to do is we've updated I think I've been involved in projects now over the last seven years and have replaced about a thousand pieces of equipment or so, but we've been able to do that without significant electrical upgrades to the buildings.

So we've reduced demand, reduced the size of power circuits required to the units, so the existing circuit can serve it and we can adjust for that with a circuit breaker disconnect right at the equipment without upgrading the power distribution. We've integrated the dedicated outdoor air systems and demand control

ventilation with energy recovery everywhere we can.

St. Johns High School, we also went in too and did lighting upgrades, converted to LED lighting and did an envelope improvement with a roof replacement. And we improved IAQ conditions and hit a 57 percent energy cost savings over the baseline and that was validated by a third party 170d third party energy assessment by another consultant. Next slide.

So again, we've made our roofs wider. We've cleaned up the roofs. We've gotten the equipment to where it's seismically and wind restrained where the old equipment weren't. So we've added to the sustainability and resiliency of the buildings as well, put all the equipment down on the – rather than go with curb adapters that set equipment up another two or three feet above the roof, we replaced the curbs, one for seismic and wind, but also to help the maintenance staff be able to get to the equipment and when they can get to the equipment and have access to it, it's easier to maintain it and tends to get maintained more often. Next slide.

And you can see from the technology that giant old dedicated outdoor air unit got replaced with the more compact unit where the energy wheels and things are arranged to where we take load off, we've not had to do a structural or roof upgrade on some buildings that have been as old as 50 years old, by taking the approach of more energy efficient, smaller and light equipment. By the way, we also run a – once we've taken into account the changes in use, reduced plug loads in a building, things like that, we run a standard ASHRAE 140 compliant building energy model on all of the upgrades to right size the equipment before we go into the renovation. Next slide.

So, Rengie mentioned my involvement with ASHRAE. I'm a former board member and I'm here in Las Vegas actually at our winter meeting and I will say that I was just nominated to become the next treasurer of ASHRAE starting in July if our ballots come in favorably. But I have been the vice chair of ASHRAE's epidemic task force over the last two years. Many of you may have heard of that, but on our ASHRAE website if you haven't, you go to ASHRAE and go to COVID-19 resources and you'll find maybe a thousand pages of guidance, depending on any building occupancy type.

But our core recommendations are follow public health advisory recommendations; improve ventilation, filtration, and air cleaning; air distribution, so look at you air distribution and adjust it where

necessary to get good mixing; and proper HAVC operations. So a lot of guidance on how to assess your systems and simple checklists to do the kinds of inspections that Ron talks about have built in and been put on automatic pilot in the Charleston County School District. And then finally, HVAC commissioning, which I mentioned.

And I will also say that the earlier speaker talked about 50 percent design guides and moving toward a net zero design guide and as of this meeting too, ASHRAE has become very involved in moving probably into the biggest initiative since we introduced 90.1 back in 1975 and that is zero net carbons. So that includes embodied carbon and operational carbon.

So moving forward, you'll see a lot of information and new standards and guidelines coming out of ASHRAE to help our design engineers, our owners, and our federal agencies to begin moving toward those zero net carbon targets we're setting for ourselves. Next slide.

All right, I'll add one last comment. The ASHRAE headquarters that was mentioned, it's 67,000 square feet. It was a 1970s vintage building and we did hit a 50 percent envelope upgrade. We completely reclad the building with a new rain screen type system that also improved insulation on the walls, windows and the roof, and in October, we went live with our solar array, so the building is anticipated to perform at net zero energy now. And with that, Rengie and Claire, that's the end of my comments.

Anthony Aldykiewicz: All right, thanks Dennis for that and thanks for pointing that out. I know you pointed that out to us in the chat for those, so I appreciate that, the additional comment about the improvements to the ASHRAE building in Georgia. So thank you for that. Thanks to all the speakers as well. So what we'll do is I guess we'll open up the session to Q&A and if you do have a question, please type your question in the Q&A box located on the bottom of your Zoom screen.

But I do have one question for Dennis. So Dennis, what I'll do is I'll read the question so that folk can hear it and then that way, you can go ahead and address this. It looks like a two-part question. First is, do you have a published case study on NEHU to heat pump replacement or could you please describe the replacement process. In parenthesis, they say modeling, cost evaluation, etcetera.

Dennis Knight: Sure. Well, most of for the last 30 years or so, most of our equipment has been heat pump based; however, our process again is we go out, we do an assessment, we do a conditions assessment, we look at the buildings, we sit down with staff both operational staff and the teaching staff and find out what the occupancy is. Is it still the same or is the space use category still the same? We run the model.

We look at lighting and whether lighting has been upgraded or if it's planned to be upgraded, same with the roof. We run those models. We generate a large spreadsheet that includes the existing equipment, its energy efficiency as well as its power service requirements. We put that side by side with new proposed basis of design equipment and we begin tweaking those equipment selections with the goal of getting all of them at or below, and normally significantly below their original power requirements. So that tends to cut both demand and consumption, I think you can see from that graph that Ron put up, that 1.5 percent per year savings has been significant.

So that's what we've done. Now when you're looking at in colder climates, and I have not worked in, but I've just seen a recent study and I will find the source of it. I believe it was a student at maybe Carnegie Mellon looking at New York City and heat pump technology has tremendously improved. We've got units that will work down to minus 37 degrees and so we're seeing that – or at least the student's projects and some of the retrofits going on in New York City is that they can meet both their heating and cooling with industrial grade type heat pumps that can product chill water and hot water, retrofit to fit a high rise building and even use the heat pump to meet heating requirements for up to 70 percent of the year and then supplement that with their existing boiler systems or newer gas boilers at reduced load and get to 96 percent decarbonization, which is tremendous, without having to do major infrastructure or structural changes to the facility.

So I think between the ASHRAE headquarters showing what you can do with a 1974 building from a cost effective standpoint and then some of the new things coming out that we can transition our existing building stock efficiently and get to nearly zero carbon emissions here within the next few years.

Anthony Aldykiewicz: Yeah. I definitely agree. Okay. Well, that was actually the only question posted. I don't know if any of the attendees, you know, if you have any other questions, what I'll do is I'm just going to kind of walk through some of the next slides and if any other questions

pop up before we finish, I'll raise them to the panelists.

So, just wanted to let the folks know that today isn't the last time you'll hear from the Building Envelope Campaign and these other campaigns. We hope that you'll join us for a second webinar in our series titled How Multifamily Buildings can Benefit from DEO Technology Campaigns. And that will be in March on the second of March, same time as this webinar. Next slide.

And just a comment on the Better Buildings webinar series slide. So if you can't wait until next month, you can go out and check out any of the webinar series. You can see that there are quite a few presentations through April. You can visit the Better Buildings Solution Center and then learn more about these webinars and also how to register for them.

And so the next slide, so the next Better Buildings Better Plants summit will take place in May, that's May 17th through 19th. And the event will feature engaging and interactive sessions as well as opportunities for attendees to network with industry peers and experts and while we aren't planning an in-person event this year, we will make a final decision I think by the end of the month as far as how that's going to play out. Registration will be coming soon for that. So visit the Better Building Solution Center just to learn more. So I don't see any other questions popping up.

So we've reached 4:00, one minute after 4:00, so with that, we just want to thank all of the panelists for their presentations. I thought the presentations were great. And then again, if anybody has any other questions, I think you will get – you do have your contact information for all of the panelists that presented, so feel free to reach out with any questions directly. And I think with that, I just want to say thanks again to all the panelists and thanks for those that attended as well. Appreciate it. That will conclude the session. Thanks.

Axel Pearson: Thank you. Thank you Anthony.

[End of Audio]

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