Brooke Holleman: Thanks, everyone, for joining. We'll get started in just a few minutes.

[Silence from 0:00:30 to 0:01:35]

All right. Why don't we go ahead and get started? So, hello, and welcome to the 2022 Better Buildings Summer Webinar Series, dedicated to bringing you the latest actionable insights from leading industry experts. This annual series is a chance to explore the topics, technologies, and trends that affect your organization, as well as efforts to accelerate energy efficiency adoption.

Before we dive in, there are a few housekeeping points I'd like to cover. Please note that today's webinar will be recorded and archived on the Better Buildings Solution Center and we'll follow up when today's recording and slides are available. Next, attendees are all in listen-only mode, meaning your microphones are muted. If you experience any audio or visual issues throughout the webinar, please send a message in the Q&A box located on the bottom of your Zoom panel. Next slide.

So, my name is Brooke and I'm your moderator for today's session, which is focused on community resilience. I'd like to get us oriented today around the topic of community resilience. And I wanted to share a map many of you are familiar with, which is the National Oceanic and Atmospheric Administration's annually published map of billion dollar disasters. This will show 2021, in which 20 separate weather events recorded nationwide cost over $1 billion in damages each, which made 2021 the third-highest year on record for the number of events.

So, as we're all experiencing, natural disasters are becoming more frequent and severe and straining our electric grid. Just the year before, in 2020, the Energy Information Administration reported that US electricity customers experienced power outages lasting an average of eight hours, which is the longest average outage duration per customer since the EIA began tracking in 2013.
So, to mitigate against the impact of severe disruption in power and to ensure food, water, shelter, healthcare, and other necessities are there when they're needed most, communities across the country are pursuing investments in energy efficiency and onsite generation and storage to keep the lights on. Next slide.

So, what are critical facilities. So, at DOE we often use this term to describe the building or infrastructure that provides essential public services that are needed to keep operational during an emergency

event. Typical example may include emergency shelters, health care facilities, food preparation, or water treatment plants. And importantly, community residents often have a strong say in what places are critical to them to have operating during an emergency event, and they need to plan accordingly to make sure that these community resilience hubs are equipped to stay online during a major outage. And two of our panelists today will share their approaches to community resilience. Next slide.

So, when considering backup power needs, whether by an existing diesel generator or even going further to add onsite generation and battery storage, making sure your building is as energy-efficient as possible is a really critical first step. From lowering the cost of a new backup power system or improved performance of an existing system, energy efficiency provides a number of benefits for resilience. It can help ensure that energy used is reserved for critical functions, such as lighting or heating and cooling. It can put less of a strain on the grid during an emergency event. It also increases passive survivability, the ability to maintain indoor air temperatures to an comfortable degree when an outage does occur. And you'll see a short, non-comprehensive list of common high-impact energy efficiency projects that building owners might consider here. And you'll also hear from one of our panelists about a powerful, freely available online tool that you can use to conduct site-specific analyses to determine the most cost-effective backup power system to meet your unique resilience needs. Next slide.

So, for more public sector-specific information, resources, and toolkits on energy efficiency and renewable energy investments, I encourage you to visit the State and Local Solution Center website. These resources also include our annual guide, "Energy Efficiently and Renewable Energy Resources for State and Local Leaders," in addition to a link to our Energy Resilience in the Public Sector webpage. We also hope you'll subscribe to our "State and Local Spotlight" newsletter, our monthly newsletter with over 30,000 subscribers. And you can also stay in touch with us at stateandlocal@ee.doe.gov. And I'd also like to note that these links and resources mentioned here and by our panelists will be available to attendees following the presentation.

So, with that you can go to the next slide and I'll tell you about the interactive platform we'll be using for Q&A, polling, and feedback. please go to www.slido.com on your mobile device or by opening a new window in your internet browser. Today's event code is #DOE. If you would like our panelists – if you would like to ask our panelists questions, please submit them anytime throughout the

presentation. We will be answering your questions near the end of the session. And you can select the thumbs up icon for questions that you like, which will result in the most popular questions moving to the top of the screen.

So, we wanted to learn more about who is joining us today, so let's start off with a few polls.

So, "What sector best describes your organization?" We have a lot of options here. Obviously our – a lot of our content is focused on our public sector folks, as we know these issues impact all of us. I see a lot of contractors. State government. Local government. And nonprofits. That's awesome. Okay. A pretty good mix. Excellent. Looking like we're leveling out here.

So, with that we can go to our next poll, which is a fun word cloud. And this is your opportunity to write in your answers to this question, and they'll appear on the screen. "What are your biggest challenges to making resilience investments?" As expected, funding, top of the list. I'm also seeing capacity. Legal authority. Community support. Old buildings. This is a really thorough list. I'm excited we'll get to get into each of these a little bit in more depth today. Outstanding.

Okay. Well, thank you all for participating in our polls, and I'm glad you know how now to use Slido. I want to shift now to introducing our great lineup of speakers. So, today's presenters, we have Ian LaHiff, who currently helms the energy performance of the City of Orlando's building portfolio, made up of over 7 million square feet, continuously driving towards Mayor Dyer's goal of 100 percent renewable energy for all city facilities by 2030. Next, we have Tony Sparks, who works for the Facilities, Design, and Construction Department of Albuquerque Public Schools, where he is Staff Project Manager for HVAC systems, energy efficiency, and sustainability. He is also Coordinator of the APS Water and Energy Conversation Committee and the APS Energy Team. Finally, we have Indu Manogaran, who is a Research Engineer at National Renewable Energy Laboratory. Her focus is performing technoeconomic analysis using NREL's REopt tool to inform onsite distributed energy strategies and decisions. Thanks to all of you for being with us today. And with that, I'd love to hand it off to Ian to kick us off.

Ian LaHiff: Great. Thank you so much for having me today. This is such a pleasure to speak with everybody and I loved seeing all those

different word cloud responses on that screen. So, a lot of different variety and great background there. Slide, please.

So, today I'm going to be telling you a little bit about the resilience hub project that we're working on at the City of Orlando. Slide.

Here at the City of Orlando we're really focused on creating equitable resilience and we believe this resilience hub project will help us accelerate us towards that goal. We also have a suite of other sustainability goals that I want to share with you. Slide.

Back in 2007 the City of Orlando under the leadership of Mayor Buddy Dyer convened a diverse stakeholder group of community members, industry partners, and other folks across our city to come up with a holistic set of goals that's really focused on seven different key areas of sustainability. We're focused on clean energy, green buildings, local food systems, zero waste, livability, clean water, and electric and alternative transportation. It's not just a set of goals and things that we're shooting for, but actually KPIs and metrics that we're tracking. And we've been doing this since 2007. Slide.

This Green Works initiative has actually morphed and evolved into other more discrete focus areas over the past couple years. Now, I'm telling you this because this is really driving towards all of our different departments' participation and we're forcing ourselves to align with these different community action plans as we move forward. Namely, some of the important ones: our Municipal Operations Sustainability Plan, our Climate Vulnerability Assessment, our Greenhouse Gas Inventory, our Community Sustainability Action Plan, our Vision Zero Plan, which is really focused on eliminating pedestrian fatalities, and then our Future-Ready Master Plan. So, as we touch on resilience investments across our city we want to make sure that we're aligning with all of these other action plans that we've perceived community engagement and involvement in to make sure that this is what the community wants moving forward. Next slide.

One of the main ones that we've looked at as we identify our focused areas of investment is our Community Vulnerability Assessment. And this action plan is aligned with the Covenant of Mayors and looked at the probability, the impact, the different intensity and increasing frequency of these climate hazards that we're facing almost all the time here, especially in the summer months here in Florida. Next slide.

As you can imagine, especially for any of the folks in the audience from the Southeast, our biggest hazard is the tropical storm season, which runs from about April to it seems like November these days. Here in Orlando we're not as vulnerable to, say, a storm surge, that tidal influx, like our friends on the coast, but we do see a lot of rising water through our different bodies of water and lakes and we're hit with a lot of the outer bands of rain from either an East Coast or a West Coast storm. It seems like every year Orlando is in that cone of uncertainty, if you will, no matter which way the storm is coming. Next slide.

This is just kind of an interesting graphic that shows since 1950 all of the different what we call spaghetti models coming at us. And Orlando is right there smack in the middle. So, we're really experienced with this and we know that with these storms comes power outages and food shortages, lack of internet access, which really disconnects our community, ice, and access to clean water. We want to get ahead of a lot of these issues and hazards, as opposed to just being reactive. Next slide.

We're also aware that every state except Florida about a year and a half ago battled freezing temperatures over the winter, and especially in Texas we saw how unprepared the state was for these different unexpected freezes. And we're actually seeing that – the opposite this summer with a lot of folks out there that are served by ERCOT, the Texas grid, as well as our friends across the pond in Great Britain who are seeing unprecedented heat waves. So, as these things happen and people are thrown into a crisis, the electric grid is unable to handle the demand, people lose power, and unfortunately some people pass away due to these hazards as well. I know at least 30 people died during that Texas issue, as well as exacerbating circumstances from hypothermia, carbon monoxide positioning, house fires, and other things that happen due to grid failures and the lack of resiliency.

Here in Florida we saw that nursing homes also suffered devastating preventable deaths due to power insecurities, and this actually promoted legislative changes that now require backup generators for these facilities. It's an example of a building that was not previously considered a mission critical facility, like, say, a hospital, but now because of its impact to the community we have to make these smart investments to be able to prevent and get ahead of these issues moving forward. Next slide, please.

So, the City of Orlando is really focused on equitable resilience, and we feel that this resilience hub project will help us accelerate

towards a lot of those goals outlined in those community action plans and hit on the climate vulnerability assessment factors that we identified moving forward. Next slide.

So, to proactively address these risks and vulnerabilities we're making these strategic investments in these community facilities. Now, these are existing city facilities that we're targeting. These buildings already provide a lot of established, trusted community-managed resources to the different neighborhoods. They're used year-round for before-and-after-school care, basketball tournaments, tee ball games, aquatics, swim lessons, Meals on Wheels. They do a lot of different amenities for these neighborhoods, and we realized that by leveraging these existing buildings and making smart investments we'll be able to serve these community members more beneficially.

We're also levering the US Sustainability Directors Network, and they have some great resiliency hub guidance documents to assist local governments and other community-based organizations to make these decisions and provide that community engagement to be able to take action with these facilities. Next slide.

As we identify these buildings and we identify the different factors that we're going to upgrade and enhance, we want to make sure that we're striving to restore what FEMA calls its five lifelines. So, the Federal Emergency Management Agency has different focus areas that we want to make sure that we're touching on with these buildings as well: energy, food water and shelter, health and medical aid, safety and security, and communications. And a lot of these touch points are already felt during normal operations. The health and medical, for instance, our city facilities were used as COVID testing centers and vaccine distribution sites. They're also used for sandbag distribution leading up to a storm. They provide food service, before-and-after-school care, and meals for students in our community. And we're already hitting on a lot of these different areas but if we're not able to work when the power's out, we basically have a stranded asset and a building that's not able to provide these services. Next slide, please.

So, we realize that this term "resilience hub" is gaining traction. It's an equity-based strategy for disaster preparedness. But it's an overarching term. A resilience hub can mean a lot of different things depending on your different area of the country and what climate risks and hazards you're trying to mitigate. Here in Orlando we're touching on a few different areas, and this may look different in your neighborhood, but renewable onsite power generation is

one of the things that we're shooting for – but we're not ruling out conventional power generation as well. Communication and bridging that digital divide is of utmost importance to us. It's really a utility at this point, and I know the FCC is adopting that phrasing as well, but it's a single point of access. People can get online, they can sign up for social services, they can connect with others and loved ones and let them know that they're okay after a storm.

We also have a broad community farm system that's set up around our different community centers, but we'll also be able to provide food pantry amenities and a place to be able to get people back on their feet quicker. Next slide, please.

Next slide. Thank you.

So, in order to do this, we've sought roughly $3 million – $2.8 million through a HUD grant last year, and we're excited to share that we actually landed that grant. We're making smart investments in six resilience hubs, six existing facilities that are going to be able to provide community lifelines in the recovery phase and leading up to a disaster. We're going to do that by focusing on a couple different areas: improving electrical infrastructure and improving the HVAC, as well as the ability to accept auxiliary power generation. Next slide, please.

These buildings have a tremendous value, like I said, to these communities. But we also know that by using a familiar site, a familiar building, people will be able to shelter at home, even if they don't have power at home, but they'll be able to go to the neighborhood community center and get what they need and get back up on their feet. It's safer in the long run than going to an emergency shelter where people are packed in. There can be some other issues and friction associated with that. This totally reduces the stay of – the need for emergency shelters. And it allows residents to spend the recovery phase of disasters in their familiar neighborhoods where they're more likely to have social supports. Next slide, please.

In targeting these different areas our team identified six neighborhoods across the city as ideal places to establish resilience hubs. We used mapping software and applications on the HUD website and aligned these facilities with distinct low-to-moderate-income – LMI – communities. We also selected larger neighborhood centers, larger square foot facilities so they have more amenities and they can accommodate more people safely. And one thing I should mention is that these are not emergency

shelters. These are not building that people are going to ride out the storm, but folks that can utilize leading up to and directly after the storm. A different government agency at the county focuses on the actual emergency shelters. Next slide, please.

So, these six neighborhood shelters were selected for their geographic spread. We are trying to have a diversity of electrical infrastructure. The transmission lines and substations are serving different community centers across the buildings – across the city. So, that way, if we have a substation that goes down that serves a series of government buildings, they're not all going to go down, because we're selecting different facilities across the city.

This map shows the median household income, with the dark rust color representing the lowest-income households and the dark blue color representing the highest-income households. So, all of our city's selected facilities – those yellow flags – are representing the lowest-income households, or the folks that are going to be most burdened by ongoing energy or the ability to prepare for a storm. Next slide, please.

We also mapped racial characteristics. The following map shows the racial, and then the next map shows the ethnic makeup of the neighborhood served by the community centers. Four of these centers are primarily African American neighborhoods, and one was actually the very first school for African American children in Orlando, built in the 1920s. Next slide, please.

The other two centers, Inglewood and Dover Shores, are located in areas of high percentage Hispanic population on the east side of town, in that dark purple. Next slide, please.

So, we're utilizing the US Sustainability Directors Network Guide as a model. We've gone through, we've identified our different facilities, we've secured funding, and now we're distilling our effort and investment into three distinct areas while still trying to incorporate these future-ready features and the different community action plan metrics that I described earlier. We're trying to focus on improving the electrical infrastructure, improving the indoor air quality, and hopefully purchasing generators to be able to land at least two of the facilities. We'll be using the latest in ASHRAE and CDC guidance on the HVAC systems and upgrading the filtration and the mitigation of indoor air foreign contaminants, so that as we're inviting people into these buildings leading up to or following a storm, we're not doing it in a

way that's going to enhance transmission or be a factor for more airborne diseases. Next slide, please.

We also realize that this is a long-term project. We're utilizing federal funding and there's a lot that goes into being able to utilize that. We're trying to get points on the board in the short term, and one of the things that we're happy to share is our small tables of connection, or smaller resilience hubs.

One of the things that we did is – next slide, please – touched on one of the FEMA lifelines and just focused in on that, the digital divide, or the ability to have that communication. We worked with the University of Central Florida and we actually mapped internet access and speed across our different zip codes in the city of Orlando and then overlaid that with US census tract data and income levels. We were able to identify distinct neighborhoods that didn't have access to this broadband internet and they also may not be served by one of these larger resilience hubs in the near future as we move forward with that project.

So – next slide, please – we actually worked with the AARP and we secured a grant for this really cool what we're calling tables of connection. They're tables, they're ADA-accessible, they actually are hurricane- and wind-rated as well. They provide charging, off-grid wireless, and 4G and 5G hotspots, along with LED lighting. Next slide, please.

So, these are some of our tables of connection. We worked with local artists to really paint some art on these areas that reflect the community that they're serving. We've seen a lot of use at these facilities. And we're happy to use this as a first way to engage these communities as we work on longer-term projects to improve the equitable resilience of these communities and facilities across the city of Orlando. Next slide.

So, you can just click through these next few slides. And these are just pictures of some of our tables of connection that we've installed across the city. I also want to add for the folks that are on the call, especially some of our contractors and service providers, we'll be pushing out the solicitation for the architectural and engineering design requirements for the six resilience hub projects, hopefully by the end of the summer. So, keep an eye out for that. Sign up for Vendor Link at the City of Orlando website. And thank you for having me today.

Brooke Holleman: Outstanding, Ian. Thank you so much for being here. And with that, we will transition over to Tony Sparks for Albuquerque Public Schools.

Tony Sparks: Good morning. Thank you. And I'm going to tell a story from the perspective of the public school sector, and that's going to be a little different. Next slide, please.

So, we are one of the largest school districts in the country, certainly the largest in New Mexico, and we have a culture of sustainability that's built in. We work hard at it. But we also have to work hard at it because it's not always that easy to do in this kind of environment. So, I'm going to tell a story of how we tripped onto resiliency through necessity or practicality. Next slide, please.

Just looking at our largest school in the district – it's Atrisco Heritage Academy High School – the largest footprint – it's kind of like a small city – and the largest utility bills. We were having issues with how much money we spent on electricity there. The summertime electricity bills are over $50,000.00, and more than half of that is demand charges for how much energy is used at any one time. So, that was a focus point for us and we decided we would do a battery storage project to shave peak in the summertime – or, throughout the year but especially in the summertime. Next slide, please.

So, we looked at a few different sites, but Atrisco Heritage was the obvious one because of its size and utility footprint. But there's some other things about it that made it very attractive to try and do a battery storage type project. It's the center of the community there. It has a large disadvantaged population. It's kind of out on the edge of town. Next slide, please.

And the demographics show that 14 percent are from disadvantaged households. Almost all of them are eligible for federal free or reduced lunch by federal programs. Twenty percent are – have English as a second language. They're not even English speakers. Twenty-two hundred is how large that school is. It also happens to have an onsite community health clinic. So, the demographics of that made it an ideal location to do something progressive. Next slide, please.

It's also pretty cool because this was the site that was chosen for the opening scene of an Avengers meeting in 2012. That's Nick Fury's helicopter flying into headquarters, Avengers headquarters

at Atrisco Heritage Academy campus. If you get a chance to watch the movie, look for that. Next slide.

So, here was the concept. We would choose a battery and put it on the grid and charge it at night when electricity was inexpensive and discharge it during the day. The goal was to reduce the peak demand below 500 kilowatts, and the demand that we experienced at that school is as much as a megawatt at any given time. So, we were trying to cut it in half. And the 500 kilowatts is already included in our base utility bill, so it would save potentially all of our demand charges if we could reduce it that much. It was also the first time we had done it, the first time any school district around has done something like this, so it was a test case for the district and a way for us to consider what we could do throughout the district to save money. But it also gave us a thought that this is a potential now for resiliency during a power emergency. We have a large battery there and we could use that to offset costs. But is it cost-effective? Next slide.

So, we went out to bid with it and the costs were a little – whoo! – overwhelming, you might say. It costs a lot of money to put a big battery of the size we were looking at. It was actually a 2884-kilowatt-hour battery and it cost a lot of money. But that's what we needed to offset what we expected to experience with degradation of the battery over a 15-year period.

So, the contractors that bid it also gave us an option for a solar panel adder, and by looking at that we could reduce the payback time of this strategy significantly. Without PV it was about a 17-year payback to just pay back the battery by reducing demand charges. With PV it took it to a little under 13 years. However, this was entirely dependent on the utility rate structure in the first case. Without PV, if the utility happened to change their rate policy, which they tend to do regularly, it could turn our financial model on its head. So, we chose to add the solar to the battery and make it a package deal. So, this doubled the project cost but it projects an overall net savings of $3.5 million over the life of the battery in the 15 years. Next slide, please.

So, what kind of battery did we choose? Well, nothing but the finest. The Tesla Mega Pack 2 was the battery that was chosen for a number of reasons, but it's quick and easy to install. It has some integral safety features built in, including a cooling system and firewall protection between cells. It's a package that you can pull off of a truck and mount on the ground.

So, I just wanted to give you an idea of the perspective of this school size-wise. If you look in the lower picture there, you can see off to the lower right, that's a parking lot and those little dots are cars. So, on the far left of that picture is where two roads intersect, and that's where our utility service entrance occurs. So, the plan was to put this battery between the building and the service entrance and intercept a high-voltage loop that goes around the campus that serves our electrical power. There is the size again: It's 721 kilowatts. That's the battery power at any one time. And 2884 kilowatt-hours. So, basically four hours' worth of discharge at the highest level gets you to that amount. Next slide, please.

So, this is kind of the layout of what it would look like. And I'm happy to report as of a week ago tomorrow – so, last Wednesday – our Tesla battery was actually delivered after a number of delays and installed on a pad in that location where you see the large blue bar, right around the traffic turnaround. We had a crane set up there, a bunch of cameras and stuff, and I watched it being put in. It'll be enclosed in a structure with cinder walls around it, but there will also be an onsite learning lab out there, access to view the battery and a solar panel mockup put on the ground there so students from the school can come and explore what it means to have battery and solar on their school.

Now, I want to show you how much solar we put on to offset the power that we would need. The next slide shows that four of these major roofs are covered wall to wall with panels. And here's an interesting thing: The count of the panels came out to about 2200. And if you recall, there are 2200 students at the school, so a great metric for you if you're planning on this type of a project is one panel per student. There was a lot of available roof space here; however, it also means if we're covering these roofs we have to look at their condition and the maintenance of them going forward. And we uncovered significant roof repairs needed and made some decisions about what we would do with the PV system to deal with the roof issues. But that was one of the things that we hadn't anticipated and we weren't necessarily going for it at the beginning with PV anyway. So, that was one of the lessons learned as we came up to it. So, next slide please.

So, here's the crux of it for this presentation. By adding solar to the battery we suddenly now had the opportunity to really consider resilience. You have a way to disconnect from the grid where you have a power generation source and a storage source that allows you to deploy it when you need it. So, this is called islanding, where you separate from the grid. So, then we added to our scope

of work a feasibility study to identify what would need to be done in order to disconnect from the grid. Ian talked about critical buildings; we talked about critical loads within the campus. And we saw all those different buildings. Well, we identified one building, the gymnasium and cafeteria and library building, that has the most resources to act as a resilience area. And we couldn't do the entire campus because there's not enough – even with all that PV and that size of battery, there's not enough power to power the whole school for a period of time disconnected from the grid.

So, the first thing we did was conduct that study, and now we're in the process of creating an implementation plan and a design for exactly what would be required for a future project to actually pull the trigger on making this an islandable and resilient hub. The next step after paying for the project that's underway is pursuing funding for the implementation project. So, next slide.

I just want to share kind of the challenges from a public school perspective. Obsolescence. Well, that seems like a weird one but it's really not, because the gears move very slowly in a public institution like ours. And we've already experienced that some of the older PV systems we put in eight, nine years ago are kind of on their last legs and they're at the low end of the technology scale. So, the battery world is evolving very quickly and PV is trailing right along with it. So, technology can go obsolete.

But also importantly, I wanted to mention here, and it's not on the list but it's a super important factor, is it's new to our utility also. We're having lots of struggles with our local utility understanding how to allow interconnection to their grid with a large PV system and a large battery that can also potentially come offline and then come back online. So, they're concerned about that. They don't know how to deal with it. And for over a year we've been in discussions with our local utility trying to figure out our interconnection agreement. We think we're right close to the end of it. And it's a good thing because the PV is installed and the battery was installed last week; it should be up and running within a month. We hope we can actually turn it on when that occurs.

The second challenge, of course, is cost. From a public utility perspective, how do you afford to do this? How do you justify doing something like this when you have needs all the time anyway? So, APS tends to be an early adopter of sustainability strategies. We have a very robust and committed team. In this case, we were able to partner with federal and state resources to make it

happen, and probably could have done it without that, but even then it's a very expensive early adopter project.

Equity is very big for a school district. If you create a resilience hub in only one place and it takes you years to do it and you can't get to another one for several more years, does that placement at one site exclude others? Is there an equity perception because you're not accommodating the whole district equally? Granted, you have to start somewhere, but that's a consideration and a challenge in looking at it.

And lastly, if any of you are involved with a public entity, leadership is a big deal. You need a champion who's going to take this project from beginning to end, and in our case we need buy-in from the district leadership. They have to allow us to do it, dedicate funds to it, allow us to interact with federal money and state money.

So, I would just leave you with a couple of questions to ask. We ask ourselves, "Can we lead the way?" And we are leading the way by doing this. "How much can we do with the resources and restrictions that we have?" And for you, "Will you lead the way?"

Now, I just want to close by showing you the partners that we dealt with – next slide, please – that made this project possible. They brought all sorts of expertise and resources, a lot of eyes and viewpoints, and certainly shared in the cost of it. But we worked with the US Department of Energy, the Sandia National Laboratories, Clean Energy States Alliance, the State Energy Department, which is Energy, Minerals, and Natural Resources Department, the school district, and the school itself, and our contracting partner, who's been really critical in making all this happen, putting the puzzle pieces together, Osceola Energy. You put all those people together and work towards it and you can have a project that is a success.

Thank you.

Brooke Holleman: Outstanding. Thank you so much, Tony. I'd like to give everyone a quick reminder. I know many of you already have, but please send in questions you have to Slido.com with the event code #DOE. I know we're all anxious to get to questions at the end of the session.

And so, now we will switch it up and hear from Indu about a really exciting tool at NREL. Indu, go ahead.

Indu Manogaran: Thank you, Brooke. Good morning, everyone. My name is Indu. I am a researcher at the National Renewable Energy Lab. Next slide, please.

So, I'll be presenting on NREL's energy planning tool, REopt, and how it can be used to provide resilient solutions for buildings. Next slide, please.

We will discuss what REopt is and how it works and also take a look at REopt Web tool where users can readily access it online to make energy decisions. We will also take a brief look at a case study from Manatee County, Florida, where we leverage energy efficiency and distributed resources to provide resilient solutions for buildings. Next slide, please.

The slide after that. Thank you.

REopt was developed in response to the increasing number of technology options available to be deployed within a site. With these number of technology options, we need a mathematical tool to provide complex analysis and provide an optimal mix of technologies that can be viable, economically viable for a given site. That's where REopt comes in. Next slide, please.

REopt optimized technology sizes and costs for a specific site. It performs complex decisions and analysis, but also provides actionable results that can be used by a diverse set of stakeholders, including building owners, utilities, developers, et cetera. It can also help guide investment decisions into these technologies. But what is REopt and how it can be used will be discussed in the next slide.

REopt is an optimization platform that takes in site-specific inputs, such as electric loads from the building, the resources that the user can select – generally it's solar PV, battery storage, conventional generators like diesel and natural gas – and the economic inputs for these technologies and electric loads. And that includes technology costs, any incentives for these technologies, the utility tariff from the utility provider. And also, since REopt performs a long-term analysis over 20 to 25 years, we also need financial parameters, such as escalation rates and discount rates to perform the analysis.

With these site-specific inputs REopt performs the optimization to provide us with a very detailed set of results that includes the technology sizes for the resources that we selected, and then puts the optimal dispatch, which is how these technologies interact with

the grid, how would these technologies interact without the load? This is the hourly dispatch information for the given year. We also get project economics. Since this – since REopt conducts a 20-to-25-year analysis we can get short-term economic results and also long-term economic results, and that includes upfront costs for deploying these technologies, operating costs for technologies, the lifetime costs, 20-, 25-year life cycle costs for this new system compared to baseline, and the net present value, how much totally it would cost to deploy these technologies. Next slide, please.

There are several factors that go into understanding if DERs have a potential for your sit, that starts with do those resources – are those resources technically viable for your site, what those technology costs and incentives are, what the site goals are, and analysis goals. We can – are we performing an analysis to get the least cost solution? Or are we adding resilience goals, renewable energy goals to the analysis? The utility cost and consumption also drives the solution, and the financial parameters, like we discussed. This is a long-term analysis, so we do need cost escalators to obtain a cumulative economic result. All of these put together provides us with the optimal technology mix for our site. Next slide, please.

REopt also provides answers to a variety of questions. For example, what is the optimal PV and storage size for a building? How much would it cost to deploy PV and storage for a building? What is the system that I need for my building to sustain a three-day outage, a nine-day outage, et cetera? Next slide, please.

Here we see a sample of how REopt works in arriving at an optimal result of technology sizes. For this sample size, before deploying PV and storage the load is provided for from electricity from the grid. That is the gray area there. And after deploying PV and storage we see that PV decreases the reliance on grid. And that decreases in turn the electricity – or, the utility bill from the electric demand. The storage also decreases or shaves off the peak from 2700 megawatts to 2200 megawatts. So, PV and storage combined decreases the energy costs and the demand costs, and that's how REopt optimizes technologies here.

We see a counterbalance in economics. The baseline, which is electricity from the grid, incurs energy and demand charges, but adding PV and storage incurs upfront costs but also saves costs from decreasing the reliance on grid. And that's the balance that REopt strikes to provide us with the optimal results. Next slide, please.

When we add a resilience goal to the analysis within REopt we also see an additional set of results that we can get information from, and that is in the form a probability survival curve, which we see here. It provides us with an understanding of what is the probability of surviving a duration of an outage? For example, in this sample graph here we see that with the generator-only system the system can sustain a 5-day average at a 90 percent probability. So, the system can sustain 90 percent of any 5-day outage in a given year. But that system cannot sustain any nine-day outages. In turn, when we add solar and storage, we see that it can sustain a 9-day outage at a 90 percent. So, that's where we see there is a benefit of solar and storage compared to just the generator. Next slide, please.

REopt as a platform has a multitude of ways that we can use the platform, including the API where we can customize the model to meet a specific analysis goal, but also the Web tool which users can readily access online. It is a user interface. And we will discuss the Web tool in the next slide.

Next slide, please.

When we go to the Web tool online the first page that we see here is on the right side, and it has all the elements that we discussed before. We first have to choose the energy goals. Are we looking for a least cost option? Are we looking for a resilience goal? Are we looking for a clean energy goal? Once we select that, we have to select our technology options: PV, battery, wind, and thermal technologies. Then we have to enter site-specific inputs, including site location, electricity rates, load profiles, PV and battery technology inputs. And also, once we select the resilience goal we have an added technology popup, which is the generator. So, we have all these inputs, and once we enter all these inputs we can select "Get results" and we are taken to the results page of REopt, which is on the next slide.

A general results page would look like this. And here we see the optimal technology size: a 4-megawatt PV, 300 kilowatt 2-our battery. And in the black bar there we also see the net present value for the system. Here we see $2 million in savings over the 20-year analysis period compared to not having PV and battery. We also see the dispatch curve, where the PV generates energy and how much excess energy is produced, et cetera, and also detailed financial outputs, outputs over – 20-year outputs, upfront costs, et cetera. Next slide, please.

Once we add in the resilience goals there are additional outputs available to use through the Web tool. We see the generator size there. We also see $2 million in net costs over 25 years. That is usually dubbed as the cost of resilience, the cost to provide resilience for the site. And we are also provided with the probability of survival for how much – what is the probability of surviving a three-day outage. Next slide, please.

Next slide, please.

So, this is a case study from Manatee County where we analyzed resilience options for two buildings, Public Safety Complex and Nolan Middle School. The goal for the buildings are to sustain a three-day outage. And for the Public – and the technologies that we used are energy efficiency, diesel generator, solar PV, and battery storage. Next slide, please.

For the Public Safety Complex a question was "It already has a two-megawatt diesel generator; can energy efficiency, battery, and PV improve the system resilience and also provide economic benefits?" And the answer is yes, as we see here. On the resilience benefit front we see the graph on the bottom there, that with only a generator, the existing generator, the system can only sustain 70 percent of any 3-day outage. But once we add PV and storage we see that that number jumps from 70 percent to 90 percent. And once we add an additional 10 percent EE, that jumps to 100 percent. So, this system with PV storage and 10 percent EE can sustain any 3-day outage, compared to not having these systems, which can only sustain 70 percent of any 3-day outages.

There is also economic benefits. So, a 10 percent adoption of EE can save $700,000.00 in life cycle costs, and that is usually resulting from the reduction in utility costs. Next slide, please.

For Nolan Middle School, it is an emergency shelter and it does not have any backup generator. So, the task was to design an optimal system which includes an onsite generator, energy efficiency, and battery storage to provide resilience for the building. Again, we see economic benefits at ten percent in life cycle savings for each ten percent adoption of EE. And this graphic showcases a very good understanding of how energy efficiency, battery and storage can be leveraged to provide resilience and economic benefits. Using only a generator can cost the system $400,000.00, but using this diverse set of resources can save the system $1 million over the lifetime, and hat's how we can leverage

energy efficiency and DERs to provide resilience for buildings. Thank you so much. Next slide, please.

You can access the REopt tool in the website provided. Thank you again for your participation. I appreciate it.

Brooke Holleman: Thanks so much, Indu, and to all of our panelists. We will now transition to our Q&A. If you haven't already, please go ahead and join us at Slido.com with the event code #DOE to submit and upvote your questions.

Okay. And I can invite all of our panelists if they want to come back onscreen. I want to make sure each of you gets a chance to answer. So, our most highly rated question: "Are there case studies of adapting libraries into resilience hubs?" And Tony, if possible I want to hand this over to you. I know you mentioned this in your discussion –

Tony Sparks: The building we chose was a gymnasium, library, and cafeteria building, so that made sense. But I think Ian might have more perspective from a community library standpoint.

Brooke Holleman: Absolutely.

Ian LaHiff: Sure. So, we actually don't have libraries that we're targeting for this. We have more of multifaceted community centers that have gymnasiums and aquatic facilities and kitchens and a lot of different amenities that you might not see in a traditional library. Although, libraries do seem to be in all of these different neighborhoods as well. So, one of the things that we're working on with our new RFP for new facilities is encompassing some of those other attributes for a library to have meeting space and to have other community features that a more traditional floorplan might not have.

Brooke Holleman: Got it. Thank you. Tony, we can go back to you real quick for a great question: "Did APS look at energy efficiency solutions prior to considering adding batteries?" And as a partner in the Better Buildings Challenge, I'm sure you can speak to that.

Tony Sparks: Yeah. I'm happy to answer this one. As I mentioned, we have a culture of sustainability at APS. We're always doing energy efficiency measures. We never stop. So, Atrisco Heritage is a relatively new school. It's about 10 or 12 years old now, I guess. But we build energy efficiency into every new project and are continuously doing energy conservation measures district-wide

where we can to make a bigger difference. So, it was definitely not ignored. It was definitely the first thing that we looked at and continue to look at in our district.

Brooke Holleman: Outstanding. All right. Moving right along, we have a question asking why building efficiency, especially insulation and air sealing, is on the list of resiliency measure. I know at least in my slides we had a very short, noncomprehensive list of efficiency measures. But Tony or Ian, do you want to speak to the role of –

Ian LaHiff: Yeah, so that's a great question, in fact. We are embedding ASHRAE commissioning practices into our efforts for resiliency. So, I didn't touch on it because it gets a little tech-y, but we're actually doing some deep dive into the commissioning of the mechanical systems – the chillers, the chilled water systems, and the air side equipment as well – in regard to not only the distribution of sealing the air, the ductwork and the building envelope, but looking at how each of the different components are working or not working, and then making those resolutions so that the building works more effectively. And to Indu's point, we can actually scale back some of the energy consumption and make your batteries, your onsite power gen last longer.

Tony Sparks: And Brooke, as you had mentioned in your initial definition of resilience, one of the first things you do is work towards energy efficiency measures. I think that's a given. I think our presentation here didn't focus on it because we were talking about some of the other parts of it. But…

Brooke Holleman: Absolutely. No, well said. Okay. Moving right along, "In moving towards a 100 percent renewable energy program, what do you to deal with the 'duck curve' concerning energy production and time of use? What forms of large-scale, long-term energy storage have you found viable?"

Ian LaHiff: Yeah, so in Florida we're not seeing that as much of an issue as, say, the renewable energy penetration of the grid, like in California, but we actually have pretty decent coincident loads because it's very air conditioning-based. The sun is shining, it's hot out, the chiller is running, you have a coincident load with the power generation. But we're also looking at hybrid energy storage. So, having a smaller, more cost-effective battery paired with conventional – and I hate to say fossil fuel, but conventional power generation so that we can use that battery as a little bit more of a gap and then not have to have one that takes us all the way through

nighttime operations, but use the generator as needed to back charge the battery so we can keep the building operational.

Tony Sparks: In New Mexico we have lots of sun and we have a huge duck curve and we work in partnership with our utility to participate in peak shaving, especially during the summer months when the peaks get really high. So, we use our school's building automation systems to scale them back a little bit during high peak events. They have access to generation use from other entities throughout the city. And so, the community participates in smoothing out the duck curve by backing out resources – or, providing resources to the grid and backing off loads during critical times.

Brooke Holleman: Awesome. Thank you both. I'm anxious to get to this next question on a request for an overview of potential funding sources for community resilience projects and financing strategies. I can just say quickly that we have included in our resources a follow-up links to both the Energy Resilience in the Public Sector page, which has a compilation of funding and financing strategies for state energy offices and local governments that you can sift through. I know that our resilience page on the Better Buildings Solutions Center has a variety of resources as well. Tony and Ian, are there any others – I know you've worked with HUD grants. Tony, you had a long list of folks that you partnered with. Anything else you would like to – either of you would like to add?

Tony Sparks: I would just comment that having relationships, building relationships with different entities and being involved leads to connections and opportunities. So, the main funding support we got was federal funding from the Energy Storage Research Project led by Dr. Imre Gyuk. And they do some things called demonstration projects where they provide federal funding to projects that are pilots and demonstrate potential future opportunities. And they happen to have a local conference, the local peer review conference in Albuquerque, and I got to meet Dr. Gyuk and some other players in Sandia Labs and we sort of made the connections that way.

Also, we are – we involve our state energy office with our monthly meetings, and so they were onboard with helping participate financially just because they know the hard work that we do to try and make everything efficient. So, those are two sources we used.

Ian LaHiff: I would just add that – think outside the box a little bit if you're pursuing funding. We targeted HUD funding that was geared towards mitigation, and a lot of other cities in Florida won it but

they're using it to restore seawalls or upgrade stormwater piping. Nobody else was using it for mitigation of existing facilities and tying that to climate vulnerability. We actually had to do a little bit of selling it to the folks in Tallahassee who were the facilitators of the grant, but they got behind it and they actually helped us increase our ask so we were able to really make investments across all six facilities that we wanted to.

Brooke Holleman: Awesome. I think we might have time for one more question. I want to make sure Indu has a chance to weigh in. Indu, I really enjoyed your presentation on REopt. Is there a way that folks can get in touch with NREL if they want to use REopt for their own facilities?

Indu Manogaran: Yes. So, the final slide contains the information on where to provide feedback or ask questions about REopt, and that is REopt – or send e-mail to REopt@NREL.gov. So, one of the REopt team members can respond to any questions that you have. And feel free to access the Web tool. It's really easy to use and you can perform a straightforward analysis with the sample site to get insight into how it works.

Brooke Holleman: Outstanding. And last but not least, I wanted to put in a plug on funding for the Bipartisan Infrastructure Law. There is about to be a lot of resources available in terms of competitive grants available to local governments and states and school districts, and a lot of those programs right now are in development, but be sure to go to the Bipartisan Infrastructure Law web page on DOE's home page to keep in touch with the latest. And as always, you can stay in touch with the "State and Local" newsletter in order to keep in touch with the latest updates.

And with that I think we will have to end Q&A. I have a couple more updates to share with you all before we end. I wanted to make sure you all know about our summer webinar series. As you can see, we have a lot of great lineup of presentations through August. You can visit the Better Buildings Solution Center to learn more and register. And we hope that you'll join us on July 26th for our next webinar, titled "Driving Decarbonization with 50001 Ready." You can join this webinar to learn how to use continuous improvement practices to decarbonize and reduce energy intensity.

I also wanted to share about our progress report that DOE releases annually with key findings, updates, and metrics from the Better Buildings Initiative. You can visit the Better Buildings Solution Center to explore the 2022 progress report to learn how DOE and

partners like we have online here are working towards a more efficient, energy-efficient future.

And if you're interested in learning more about the topics discussed today, I encourage you to download our "Additional resources" handout from the Zoom chat box. The handout contains links to resources from Better Buildings and our speakers. And with that I'd like to thank our panelists so much for taking the time to be with us today. Feel free to contact our presenters directly with additional questions or if we couldn't get to your question during the Q&A period. I encourage you to follow the Better Buildings Initiative on LinkedIn and Twitter. You can all find our handles by our respective icons on the lefthand side. And you'll receive an e-mail notice when today's recording, slides, and transcript are available on the Better Buildings Solution Center. Thank you, everyone.

Ian LaHiff: Thank you.

Tony Sparks: Thank you.

[End of Audio]

Shelter from the Storm: Powering Community Resilience Hubs

Additional Resources

Learn more about the topics discussed on the webinar by visiting the resources below.

Better Buildings Resources

- Energy Resilience in the Public Sector webpage
- State and Local Solution Center resources
- State and Local Spotlight newsletter
- State and Local Solution Center financing resources
- Energy Efficiency and Conservation Block Grant Program – Bipartisan Infrastructure Law 2021 webpage
- Energy Efficiency and Renewable Energy Resources for State and Local Leaders
- REopt Web Tool

Explore more resources on the Better Buildings Solution Center

Up Next in the 2021-2022 Better Buildings Webinar Series

Driving Decarbonization with 50001 Ready
Tuesday, July 26th from 11 am – 12 pm ET

Learn how to use continuous improvement practices to decarbonize and reduce energy intensity through DOE's new 50001 Ready decarbonization management guidance.
Register here

Breathe Easy: Indoor Air Quality in Education Spaces
Thursday, July 28th from 11 am – 12 pm ET

Learn from subject matter experts and partners about air quality practices to consider in a variety of education spaces, including labs and classrooms, that can improve indoor air quality and promote health.
Register here

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