Greg Dierkers: Okay, welcome everybody. I'd like to welcome you to the '21-'22 Better Buildings Webinar Series. My name is Greg Dierkers and I'm with the Department of Energy. The webinar series for Better Buildings is dedicated to bringing you the latest actionable insights from leading industry experts, some of which you'll hear from today. This annual series is a change to explore the topics, technologies, and trends that affect your organization, as well as efforts to accelerate energy efficiency an option.

Before we jump in I want to provide a few housekeeping points. First, please note today's webinar is being recorded and it will be archived on the Better Buildings Solution Center. We will follow-up with a recording and slides when they're available shortly after the webinar.

Next, attendees are 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 Chat located at the bottom of your Zoom panel.

So as I mentioned my name is Greg Dierkers. I'll be your moderator. I'll be presenting a few slides as well. I'm with the Department of Energy's State Energy Program and the Weatherization Intergovernmental Program Office. Within the weatherization program the state energy program supports all 56 states and territories and we're here to serve you and you'll hear a little more about this going forward.

So I want to introduce the topic today and before turning to our speakers. The main thing we want to cover is I want to start with a little bit of background on Field Validation.

As you can see from this slide field validation is really a way to test a performance of a technology that has showed promise in the lab in a research setting, but it does not, it, it needs additional validation in terms of the performance and cost data. Some of this information is important, because it, if you don't have it it inhibits technologies from reaching the marketplace.

So the role of DOE is Office of Energy, Efficiency, and Renewable Energy and my office is we work directly with state and local governments and other partners to identify, install, and monitor technology to get that validation data.

So if you can go to the next slide.

So today I want to talk through a little bit about what we're going to cover in a little more detail, give a little bit of sense of where we're headed with this call and this webinar.

In this, in this slide we're showing some example really about what we're getting from a validation project. There's some technical examples here of what data we're collecting and some of the market adoption examples in the second part of this slide.

So for the technical side of validation we're really trying to understand what the energy saving might be from a technology. We know what, what the lab data show, but we don't have a sense of how it operates in a real world and thus a validation pilot program or a project like we'll hear about today is essential to ensuring that utility cost savings, demand reduction, and occupant satisfaction that we think we understand can be tested.

Then on the market side the information collected will help companies and third parties, vendors, and others understand where the technology is most applicable in building size, the building sizes, and how the operating characteristics of the technology fit within the operability needs of the building and most importantly and maybe not most importantly, but very importantly is the need for the technology to work in partnership with the human side of things, the staff, and operations management that is important.

So if you go to the next slide.

DOE's Office of Energy, Efficiency, and Renewable Energy is really supporting validation work across our programs, so the Federal Energy Management Program, WIP, where I sit, the Building Technologies Office, and the Advanced Manufacturing Office are all collaborating to identify opportunities for validation. We're really looking to scale and enhance the validation work that we're already doing. So we have a number of technologies that DOE has supported or help support that are not deployed as maybe as widely as, as the potential indicates.

So there's, if there's emission savings, benefits from technologies for example, we want to make sure that these technologies are, are tested in the real world. And that's the point of this validation project is we want to identify state and local governments and federal partners that can validate technologies. We want to do more of this and we want to scale this up as mentioned.

So if you can go to the next slide.

Just a quick note on the role of the site. So I mentioned we're really looking for state and local partners and public sector partners buildings to validate technologies. And it's really fantastic opportunity for local governments, state governments to work with DOE's experts at the National Labs and we'll hear from them today about this and to support validation projects.

So we have a really exciting opportunity that we want to sort of talk you through using Illinois as a case study today. So we'll talk a little bit more through the role of the lab and the role of the site itself as a state.

Go to the next slide.

So just a quick – I won't spend too much on this, but this is a quick example of a validation schedule. You can think about it as a, as a deployment of, of a near-commercial technology. So there are some issues, some time around site selection, installation, testing and evaluation, these all take a little bit of time you know, but we've found – we've been able to map out this time to some degree and can provide a little more detail on what each of these bullets look like. So you'll hear, you'll hear more from us on this and we can reach out for details on this.

Go to the next slide.

So I won't, I won't dwell on this, but the benefits to state, local, and tribal government participation really are the opportunity is to be part of a low-risk pilot with support from Department of Energy and National Labs to setup a validation project and to help us collect the data that's needed to scale technologies.

Let's go to the next slide.

Thanks. Okay we're going to do a quick poll now. To do the, to do the poll you'll go to this website here. I'm going to go to my notes so I make sure I get this right. This is an interactive poll and it allows for some Q&A and feedback. If you go to slido.com: S-L-I-D-O-.-C-O-M, on your, on your phone or opening a new window on your computer, type in #DOE, that's the code for today and then we'll ask some, ask people to, ask some questions and get your feedback. So if you got to Slide 11 this gives you a sense of where you're from and it looks like folks are starting to populate this already. It will give us a sense of what sector you all are answering from. So I'll pause for just 30 seconds and let people populate.

If you're having any issues with the Slido poll we're going to do at least one more of these, please reach out using the Zoom Chat function and send a note so we can make sure to get you connected to this poll.

Okay it looks like a good mix here in industrial manufacturing and multifamily housing. This is great. I'll just add and then there's a fair amount of state and local participants and contractors and so great. Well we will have a lot of content here for everybody. So I want to give us another minute on this poll.

It looks like, yeah, without Slido I don't think you'll be able to run, you'll be able to participate in the poll, but our contact information is available and so we'll be able to answer questions and talk with you further afterwards. *[Clears throat]* Excuse me.

Okay, all right so without further ado today's presenters – I'm really pleased to have a great lineup today. From, from left to right we're starting with Chad Kruse, is going to be talking about – Chad and Kevin Dwyer are both going to be talking about the experience that Illinois has had in working with DOE and helping out.

Chad has a decade of environmental law and policy experience with the State of Illinois. He worked, he's worked with the Illinois Environmental Protection Agency and that includes serving as an assistant legal counsel for the Bureau of Water. Currently he is the manager of the Office of Energy, so he's the Energy Office lead for the State of Illinois.

Kevin Dwyer is the Director of Environmental Health and Safety for the Illinois Department of Central Management Services. This means Kevin is responsible for development and implementation of environmental health, environmental health and safety policy and procedures for CMS and establishes projects in this capacity for energy conservation, furthering the department's sustainability initiatives.

Then after we hear from Illinois, from Kevin and Chad, we'll hear from Guanjing Lin and Armando Casillas. Guanjing is a Principle Scientific Engineering Associate in the Building Technology and Urban Systems Division at Lawrence Berkeley National Lab. Her research interests include building energy performance monitoring, fault detection, and diagnostic, and building operation and commissioning.

Armando is a Scientific Engineering Associate also at LBNL and he's been there at LBNL since 2019. He works on a number of projects relating to building efficiency, including grade interactiveness and flexibility and HVAC fault detection diagnostics.

This is the team that has worked with us on the Illinois Project. So without further ado I want to thank everybody again for joining us and I'll turn it over to Chad Kruse and Kevin Dwyer to kick us off.

Chad Kruse: Okay. Thank you so much, Greg, for that introduction. I just want to say thank you to DOE for initiating this project in Illinois and for inviting Kevin and I to talk about the project today to this audience. Thank you all for joining.

Again, my name is Chad Kruse. I am the manager of the Illinois EPA Office of Energy and the state energy office for Illinois. I'm going to talk probably the least of all the presenters because the State Energy Office's role in this project was really quite simple and that was to convene the necessary players in Illinois over a project of this nature, which is a part of my job that I take very seriously.

I do want to say just a word about each of the priorities you see on the screen right now on how this project really helps us to advance those priorities for and across the State of Illinois before turning it over to Kevin who will talk about some of the more technical aspects of the program.

So first, the four priorities that really came to mind when I think, when I think about this project are our, our philosophy that energy efficiency is a great resource. Secondly, our priority to lead by example as a state agency and as a state government. There are ways of convening the stakeholders over energy projects. You've already heard me say that that's a role or a responsibility I take seriously in my role at the State Energy Office. Finally, reaching the entire state with viable energy projects.

So just a work about energy efficiency as a resource. At the State Energy Office we see energy efficiency as the first and most important step towards a cleaner and more resilient energy future in Illinois. This project will save energy at an older State of Illinois facility with technology that may pave the way for additional energy efficiency investment at that facility and broader across state facilities in Illinois, especially in collaboration with Kevin and his group at CMS and the lessons we learn from this project.

Secondly, lead by example is – has really been highlighted for the State of Illinois and Kevin and I since Governor Pritzker signed onto the US Climate Alliance in 2019. The US Climate Alliance has a workgroup solely focused on state governments leading by example. As I said we joined in 2019 and Kevin and I hope to make greater strides at state facilities following this project and the lessons we learned. We feel fortunate to have DOE and LBNL helping us to pave the way on this project and leading by example.

Thirdly, convening stakeholders. Kevin and I both feel strongly that new things will not happen and projects will not develop unless sharing happens early and often among state agencies and among important stakeholders. Kevin and I have been in our roles for similar time periods, but actively collaborate as a part of at least three important groups.

First, we have an Energy Efficiency Committee that was formed by a previous governor that Kevin actively worked to reactivate that group so that we have a talk every month among energy policy makers in Illinois on how we can change things up for Illinois in a good way.

Second, the Climate Working Group is a group that my supervisor, Heather Nifong, Illinois EPA and I set up and has been going two years now. It's a convening of climates policy makers across the agencies. On a monthly basis we have really powerful presentations, followed by a question and answer periods, along with just updates from various state agencies across issues like housing, like emergency response, like Kevin's group at Central Management Services and like public health.

Thirdly, the USDA Lead by Example group that Kevin and I both participate in is a great convening of groups across the nation focused on helping state governments take steps toward more sustainable state governments with the hope that private and public groups follow in our strides.

These three have all been stood up since Kevin and I took our roles or reactivated since Kevin and I took our roles and that's not by accident. It takes works to convene stakeholders and it's important work to do.

Finally, reaching the entire state with energy work as a priority of the State Energy Office and that's, that's meaningful in Illinois, as it is with other states for the reason that we have a big city, that's

Chicago, and that's where Kevin and I happen to live and work. We have state government focused in Springfield, the state capitol, but this project is up in Effingham, Illinois, which is south of Springfield and in area that's driven by industry and agriculture and an area that maybe state workers aren't seeing investments like this frequently. So that's another aspect of this project is spreading our investment, our energy investment across the state.

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So just a word about how this project came together. Greg approached me in February of 2020 and just planted the seed, "You know would you be interested in doing a field validation project in Illinois at a state facility?" Simple – all, for all the reasons that Greg highlighted at the outset of the Webinar, it was very attractive. And we just went about bringing the groups together to see what would come out of it.

And then we started getting really meaningful and truthful feedback from LBNL, DOE and Kevin was onboard and so it came together to really make this fantastic project that you're going to hear more specifics about from Kevin.

So Kevin with that please go ahead.

Kevin Dwyer: Thank you Chad. So I would like to start with just a spend a moment on Central Management Services, who we are and what we do. The Illinois Department of Central Management Services we work as the operational engine that enables the state's more than 80 agencies, boards, and commissions to deliver services. We have many bureaus some of which you know for example that we have a Bureau of Procurement and Fleet Management, Property Management, and of course Environmental Health and Safety Division, which is the division that I oversee. And within that division we have Energy Management staff. We are who lead energy efficiency such as this what we're discussing here today.

So to dive in a little bit. When the fields validation program was brought to our attention I saw it as an excellent opportunity to you know work collaboratively with our other government entities toward these common goals. You know the initiative to save energy at our facilities, save, save money by doing so, and also to have a project that provides that valuable data from monitoring and validation, which gives us you know a real-world example as was mentioned before that these projects do work and you know we have lessons learned and successes throughout the process.

At CMS we manage a portfolio of over 670 state owned and leased facilities, so we're continuously looking for opportunities for energy efficiency in the portfolio. We had some criteria to consider when we had gone through the site selection process for this particular project.

And so using that site selection criteria that I will go into a little bit, we'll go from top down. We narrowed it down to a building in Effingham, Illinois. Effingham is located in the central-southern region of Illinois and offers a good climate for you know a bit of a national representation of climates across the country. So you know average highs can range from you know or exceed the upper-80s and winter lows get below freezing, so it gives us a nice variety of weather to use as our sample site for this location.

The building that was selected is an administrative office. It's a two-story building, it was built in 1933 and has a brick exterior envelope.

When we were selecting the site some of the criteria that we were looking at was that it was a commercial office building and that it did not have an existing building automation system and that it was a small-to-medium-size square footage.

At CMS we manage buildings all the way from small up to, to very large, some that have very simple controls, up to you know our larger buildings that have networked full building, building automation systems. So we needed to narrow, narrow it down to that criteria of a small-medium, as well as not having automation system monitoring in place. The size of this building for this project is 2,600 square feet and it did have a simple thermostat that controlled rooftop units.

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So we'll get a little bit into the meat and potatoes here. So at this site you know as mentioned they're not under any control of a building automation system. In fact the stats go into these rooftop units, we're just simple thermostats like you'd find – you know where you just set a temperature and it works to maintain that temperature set point.

We were also looking for some newer equipment, which created you know, it kind of knocked some of the buildings out, because generally when you have newer equipment installed it is paired

with some of the newer temperature management systems or smart thermostat, but in this instance we wanted to have a baseline where we did not have temperature, a smart thermostat controlling the rooftop units, but they were ten-years or newer. So this site did meet that criteria.

We found that at this site there was five rooftop units. They ranged between seven-and-a-half and ten tons. These are DX cooling and gas fired. You know heating and cooling again as controlled by one single simple thermostat.

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And this is where it really does start to get exciting is where we get into the, the meat and potatoes and that's data. You know so one of the important pieces of this information or important pieces of this project is having access to the information, the data that, that we need that gives the lab, who will speak next in this presentation, something to work with.

So at Illinois here we have a state maintained utility database. It gives us a little bit of a bigger picture of our energy draw and costs. It was fortunate enough that our utility company in this area, which is Ameren Illinois, they had a previously installed smart meters. So we were able to tap into that smart meter information and pull out that interval data and I think it could be filtered down to as little 50-minute intervals for the data. So this gives us a lot of information pre-project implement and then you know after implementation and then for the monitoring and verification period.

So right now we're in the planning phase. We have gone and talking about and going through the selection of the thermostat that would be replaced in place in the simple thermostat. The criteria is that you know they have they're programmable. It's – we should be, we need to be able to have them be able to set a schedule and have setbacks. This will give us the ability to schedule occupied and unoccupied periods at this building and really see what a small change like that and a very low-cost change how it affects the load draw and the energy savings at the building.

We're also going to install a data logger. What this data logger will collect is the power that's going up to those rooftop units. So we'll have sensors around the leads going up to those rooftop units, collect, sucking in that data, and then sending it over to our partners over at Lab for analysis. They are going to provide reporting and feedback on what they're seeing and how, you know

why that's meaningful and what we can be doing during the monitoring and verification phase to continuously improve operations at the building so that you know not only are we striving to save money and bring our energy draw down and lower our carbon footprint, but we, you know we, CMS is an organization that works for other state agencies, boards, and commissions so we want to make sure that the occupants inside of our building are comfortable as well. So we will have a real live data or you know yesterday's data to look at what's happening inside of the building and make sure that we're providing a comfortable environment for our local agency or our sister agencies the people that occupy them.

So the anticipated benefits of the project, I think the energy savings and cost savings by implementing just a simple change like going from a thermostat that is just one that's allows to program a set point to one that gives you the ability to set setbacks and scheduling is a bit of a obvious change. Another added benefit is having a vast amount of data that's associated with this. This gives us with the analysis and the reporting that will come out of this, this gives us reasons to you know further implement a pilot like this at other locations or to refine practices that worked here at this building and apply them to other buildings where we have a similar infrastructure.

Currently, we have our Department of Innovation and Technology looking at the devices which we plan to use, because they will be networked and cyber security is a very important topic especially now. We want to make sure that we don't expose ourselves in any unnecessary way. So we're going through a governance process with our Department of Information Technology. Once we get our devices approved or we get devices – we have to pivot and get devices approved the next step after that will be an implementation of the smart thermostats and the data logger. So that's just a matter of installing them and getting the data logger hooked into the network and start recording information.

So we're really looking forward to moving into, into that next phase and that's when our colleagues over at Lab will really start to be able to pull together a lot of good information and help us make decisions as well.

So that ends my slide deck.

Greg Dierkers: Okay, great, thank you Chad and Kevin and as you can tell Chad and Kevin are a dynamic duo and they collaborate naturally and

frequently on this project and in many other areas that are relevant. So we're going to be sharing more on this, on that collaboration of this approach documented, but the main point is if you're a state and local government on this call and one takeaway from this is you're a state or local government on this call and you're interested in working with DOE you know we certainly wouldn't want early discussion to be with, with Chad and Kevin to follow the process, but it's been a really wonderful working relationship.

We now turn it to another key part of our team Guanjing Lin and Armando Casillas from LBNL.

Armando Casillas: Thanks Greg. Hello everyone. My name is Armando Casillas, I'm a Scientific Engineering Associate at Lawrence Berkeley National Laboratory. I'm here to present to you who we are and what we do and our role in the technology field validations, along with my colleague Dr. Guanjing Lin.

Next slide please.

So Lawrence Berkeley National Laboratory is predominately funded by the Department of Energy. We're located in Berkeley, California, in particular the Building Technologies and Urban Systems Division, attached with the Commercial Buildings Research.

Our team in particular conducts research related to the development of EMIS, Energy Management and Information Systems, as well as topics related to data analytics to enable energy efficiency in buildings, as well as things like decision tools, simulation tools for building design, integrated systems, as well as advanced controls.

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So LBNL conducts these third-party performance measurements and verifications for these technologies which are tend to be selected by programs such as the DOE High Impact Technology Catalyst, as well as GSA proving ground annual solicitation.

So LBNL is pretty excited to see the new administration's assist on the deployment of energy efficiency and decarbonization. We think LBNL is in a prime spot to support these goals. Since the work we do here helps derisk and demystify some of these technologies because you get to see how these technologies

perform in real buildings and how their value assess by an impartial party which is, whish is us.

This empowers stakeholders such as building owners and operators to adopt and deploy these technologies in their building stock, in turn further enabling the growth of energy efficiency and decarbonization in, in these, these fields.

Our team has conducted and continues to conduct a number of these validation projects. My colleague, Dr. Guanjing Lin, will go into more detail on the completed building, BuildingIQ validation project and further on I'll go into detail with some of the details of the BEM controls WiseBldg project that we're currently working on that Kevin and Chad have gone into a little bit.

So without further ado I'll turn it over to Dr. Guanjing Lin to talk about BuildingIQ. Thanks.

Guanjing Lin: Next slide please.

Hello everyone. I'm Guanjing Lin from Lawrence Berkeley National Lab and the technical lead of all the field validation projects that is conducted by our research team.

So as Armando just mentioned we have completed the BuildingIQ field demonstration two years ago, so I would like to use this as an example to let you know how this field validation what is this process and what we can get from this very good technical validation project.

So as you can see on the left BuildingIQ it is automated system optimization technology. What it is do it is it has a system model and it also have a predictor building load and then we combine this information with the real-time data that is gleaned from all the building automation system to determine what is the optimal set points for the air handling units, with a goal to minimize the energy cost of the whole building system.

So it's not only determine the optimal set points, but also it echoes right back this optimal set points into the air handling units to achieve the energy savings.

So in this project you can see the validation process. On the right I have a flow chart here. So first LBNL developed the site selection criteria. So basically we have a set of required and also preferred building characteristics and now we distribute to the potential third

party who are interested to hold a field demonstration and they will check this criteria to see okay if their buildings meet with this required like building size, like the HVAC equipment integration, like historical energy consumption data. And the _____ based on the information _____ wide we work together to decide what is a good testing site for this field validation.

So once we select the building site and then we will start to erect the iteration plan to basically the plan will define what is the iteration objective and what the analysis approach we'll take and we have a whole project schedule.

After that the technology is installed and commissioned on site and of course we will closely check this process and documentary insights. And when the technology is operating in the site we conduct the data analysis looking at the energy consumption, looking at the system performance data, talking to the building operator and the other energy management team members to understand what is the feedback. And at last of this project we write the whole research findings in this technical report. The report is available on the Better Buildings Solutions Center.

Next slide please.

So for the field validation project what we will evaluate. So we are now looking at the energy consumption and utility cost savings, it is the key things we will looking at, how much energy savings can achieve by the technology, but also we are looking the other non-energy benefits. So for example, how the occupant's comfort is impacted by the technology and now how this technology will be used in this daily energy management process. We are also looking at all the items that will impact the future adoption by the all the users, for example how long that it will take for the technology to be installed and the commission on the site. How much support is needed from the site staff and what extra activities they need to be involved in this installation, as well as operation state of the technology. We are also looking at cyber security concern and also all the specs that is needed to achieve the maximum benefits of this technology.

So for this specific project the BuildingIQ Field Validation we have selected four buildings that including office and clubhouse, a high school, and also university campus, sorry, and also hospital building, so we have four building types in this field validation. So they are located in different area of the America.

Now we conduct this long-term assessment, it lasts from 7 to 15 months. So this is one listing for public validation, it can evaluate the technology for a long time and see its performance at the different weather conditions.

In the results we are not only showing what is the savings numbers, but we do express in detail how the savings were achieved from the technology and we are also looking at the practical applicability and the generalizability and also robustness of the technology.

So for example in this technology validation we find out this technology can at the minimum achieve nine percent of energy savings under the conditions when the building system is running at very good condition. If the building has some special control requirements, for example it has very strict humidity requirements at a site or some indoor pressure requirements then the system may not perform as well as expected.

So that is a third thing we can get from this kind of validation project is to inform the research needs for this kind of technology, how it can be done better in the future.

As I just mentioned all the results are published on the Better Buildings Solutions Center and you can access the final results from the link that is shown on the slide.

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Yeah, so right now we are, we have two ongoing technology validation projects. The first one, the Nantum BuildingOS Technology it is a cloud-based building operation system. So the things I would like to highlight for this technology it installs the occupancy comfort at different floors and it's actually using this occupancy data to provide the better control of the buildings.

So now we are testing this technology in the office building in Washington, DC. So this testing site is also one of our Better Buildings members. Now we are doing the validation and expect to complete the validation next in the spring next year.

The second technology validation we are doing right now it is the BEM Controls Technology that Kevin and Chad just mentioned. So this is a low-cost building control system for the small and the medium size buildings. It will provide the control capabilities of the thermostat of the rooftop units as well as the lighting system

and it also it will provide a worry-proof safe weatherization and the analytics on its software platform.

So thank you very much for the support from Kevin and from Chad to coordinate the site and the technology provided us and asked together to doing this technology validation.

And the third one it is a new technology validation we just start to approve the site. So this is a high efficiency filter for the HVAC system. So we are just start to select a site for this technology.

Okay, now I will turn over to Armando to let him introduce multi list and control, a low cost building and control system for technology validation.

Armando Casillas: Thanks Guanjing.

So I'm happy to present to you the ongoing examples of the field validation project which Chad and Kevin have already gone through a little bit. You know this involves a technology called "Wise Building" as a platform developed by BEM Controls, a company out of Virginia, you know which uses controls as an optimization in its platform for small-to-medium commercial buildings, in particular buildings without building automation system already in place. This enables deeper energy efficiency you know strategies that can be enabled by the building operators there.

So the first part of the slide highlights an example of our site selection criteria, most of which Kevin has already previously covered. You know we were looking for a small-to-medium commercial building commissioned by thermostatically-controlled rooftop units. We were originally looking for an analog manually controlled thermostat, something that you couldn't program already, but, but we found these thermostats during our survey, although digital are being controlled to a constant set point 24/7, so they ended up being, having great energy savings potential, so we went forward with that.

In addition to that we also needed access to a stable Wi-Fi network, although there are intricacies and nuances given that this is a government building that we need to get over. It's also nice to have the ability to install sub-metering, as well as have historical baseline electrical and gas data. This is really important for our measurement and verification and performance assessments for us to develop a baseline, to then also measure during the performance

period to develop that savings, that savings number that we need for our validation process.

We're meeting with Illinois pretty regularly around like biweekly or monthly for the past couple months. Due to COVID you know usually we're able to go to the building site and perform walkthroughs, but due to COVID that wasn't available. But with the wonders of modern technology Kevin hooked us up with a couple of the building operators and we were able to conduct virtual walkthrough of the building for us to identify key characteristics of the building, including the location of the electrical panel in relation to the rest of the building for sub-metering to be installed, as well as the make and model of the thermostat you see here on the right and the set points that are currently in place there.

These are things that we keep note of throughout the beginning of the process, the installation process and document in our field validation document at the end of the, that we fill out at the end of the performance period.

So that's it for us. Thank you so much for having us and Greg for leading this discussion, appreciate it.

Greg Dierkers: Great, thank you Guanjing and Armando for the presentation. We're now going to have some Q&A. So this is your chance to ask questions. You can submit your questions as you see at the bottom of the slide using the Slido application.

Here's a few that have come in. Okay and you can turn your web cams on if you want too, you can try to read these, these questions out as…

Okay, so the first one here that's come in is that the question, the person with the question here says: I've read about the DOE validation studies for Natural Gas Heat Pump technology. What is the market adoption or outlook for these types of heat pumps? Are Air Source Heat Pumps more efficient and better suited for residential application? This probably goes to Armando and Guanjing.

Guanjing Lin: Yeah, so the structure of DOE field validation process of I think I forgot to explain this at the presentation. It is each year the Department of Energy will have this annual technologies selection. So it will call out to the technology providers say, "Okay,

recommend to us your technologies" and it will have a very rigorous selection process to select the technology to be test.

So at the Lab so we have four National Labs will conduct the field validation, not just at the Lawrence Berkeley National Lab, we also have the Pacific Northwest National Lab and National Renewable National Lab and as well as Oakridge. So each national lab will be assigned to one or two technologies to conduct the measurement and validation.

So I believe natural gas heat pump it is conducted by another national lab, so which I'm not really familiar with, but I do encourage you to contact the author of this validation studies and they can provide you more information about the questions here.

Greg Dierkers: Armando, anything to add to that?

Armando Casillas: I'll just add that I, I just overall encourage the adoption of heat pumps just in general, right, in terms of electrification of buildings heat pumps are a great alternative to gas-powered heating technologies, so yeah whoever asked that question we encourage you to first read that report and consider applying some of those in your building.

Greg Dierkers: Great and yeah I'll second that, heat pumps are, are a priority for DOE and so and there's, there's certain research and deployment projects that we have ongoing in addition to the validation effort we hear about today.

So for several of these questions it looks like there's questions about the technology which we can – specific technologies and typically how this works is there is a – Armando mentioned the high impact technology catalyst program. There's a, there's a pretty large list of technologies that are near-commercially available or in some cases commercially available that DOE has supported and have been validated and have been vetted for their certain criteria, including emissions reductions, cost savings, other benefits you know and, and we've identified as potential for market scale applicability.

So if you have a technology that you're interested in and you've heard about, read about, reach out to the – you'll have our contact information to reach out to me and we'll make sure that you get detail on that technology and maybe it's a candidate for validation. So it's – this is a feedback and we want your ideas for what we can validate and there's a good chance that we are, we're both thinking

about you know both sides, the public side, side of this and the DOE side we're thinking about the same thing.

So but it helps – we need to hear from you, you all to, to let us know where your interests lie in terms of technology applications.

And so then another question here I think it goes to the Illinois team: Are there any, any technologies that will help with that interpretation? I think you've, you've covered that and then related to that is the question about the AMI data, there's a question here about you know how, now AMI data was, was collected and how you'll continue to, to work with that. Are there issues with the AMI data? I think that was a key to this project as well. So Kevin and Chad maybe you want to touch on those, the interaction and the AMI data.

Kevin Dwyer: That's a good one Greg. So you know for the technology's use helping data interpretation you know the data collection will be done through that data logger and then the processing of it and, and software tools are done over with our partners over at Lab. But to Nick excellent observation on the utilization of the AMI feeds versus using a sub-meter or day logger.

You know by measuring the data that's coming from, from the sub-meter we are just pulling data. We're able to narrow down the data to what, what those particular rooftop units are using independent of all the other loads that might be going on into the building. So then we can compare that full load from the building meter to what we're measuring from the, from our control, right, the, the, units, the rooftop units that we've taken control over and changed whatever variable it is that we're, we're changing to see a whatever efficiency is apparent from it.

Guanjing Lin: Yeah, I will add to that. So basically when you decide if you are only using the utility AMI data that is 50-minutes into the data you usually see, also you need to install a sub-meter to capture more of, more accurate energy use of some equipment in the building that depends on the energy savings potential of the technology. If the technology you have seen it will achieve a very big energy savings number at the whole building level for example 20 percent. Then we say, "Okay, your utility level data is enough with cost of the energy trend use trending. The trend is bringing from the technology. You can clearly see from the whole building in the data."

But if like this project we are only in control of a subset of the HVAC system, not all of the rooftop units, but only five of them, then we don't need to install the sub-meter to actually capture energy consumption trend use of these five units. Because if we are looking at the whole building now what we may see lighter changes just because we are only a part of the rooftop units instead of all of them.

Greg Dierkers: Another question that's come in is that who is going to kind of maintain the equipment and collect the data over the long term? And I think this is really the importance of the building manager who's on site and so Kevin you may want to add to that, but I'll just quickly say that you know that's, this is an important question and the technology that we, we install you know there, there is a cost-share between the lab and you know and Illinois, but we're not taking the technology back, right? So it's, it's, it's, it continues to operate over time. Kevin

Kevin Dwyer: Sure. The building selected for this project it's a state owned building, so we do own and operate it. You know the, the data logger will be, will be networked, so hopefully we'll be – what, what our plans are is to continue after the verification period to continue to track it and analyze the trends that the data logger will, will be providing for us.

Greg Dierkers: Great, great. So Chad Kruse I know you have to drop off, anything you want to add to the work on Illinois and the questions you're hearing that's in here?

Chad Kruse: No, I don't think so. Thank you so much again for the opportunity and the attention to the project, DOE, and LBNL, thank you so much.

Greg Dierkers: Thank you Chad. And as always you know we'll, we'll make sure that the participants on this call can get in touch with the team here.

I want to answer a few of the questions and I think that are related in terms of the types of technologies. There's a question here on our net zero buildings, part of the study have and what about a whole building assessment? Comparing efficiency opportunities around windows and, and shading. I think those are all excellent questions. I think the answer is that there is, I think the answer is probably "Yes," but on these I think there's a lot of opportunity for you to bring a technology to us at DOE and I can get my colleagues in the Office of Energy Efficiency and Mobile Energy are your first step. You'll see, you'll see our name in a minute and

our e-mails and you'll have those later, but there, there's an opportunity to work in state buildings, local government, state and local government buildings, K-through-12 schools, and other facilities that, that are public, including federal facilities, but mostly today talking about state and local and again yes K-through-12 are eligible.

We're looking for more project and location ideas, absolutely. We want to make sure that we really that this as you've probably heard from our Secretary of Energy, Jennifer Granholm, you know she wants to deploy, deploy, deploy. And so these validation projects are sort of in the central step to deployment and again DOE has a suite of technologies that we are, that, that we would be eager to, to work with you to, to help deploy through validation projects. So the work that you've heard from Illinois is, is really essential to that deployment process.

And so, and, and in addition to questions around data in, in terms of do we have emissions and data on natural gas versus electric. I think we could get to that, get you that information as well. And I'll just to add that building automation is important, something we've, we've got toolkits on that topic that we can point to. Cyber security is an important part of – baked into everything we do, as is energy and environment justice and equity. So if there are technologies that you're, you're looking at in particular communities that are, that are important or in particular, you know or particular companies that you want to work with that's also baked into everything we want to, we want to do and are doing at DOE.

So please reach out. Let's go to the next slide. But again we really look for you partnership and it's really up to the state and local governments. If you all reach out to us we'll do our best to make, to make a connection and see if we can partner with, with you all.

So this just sort of provides my e-mail here, Greg Dierkers, and my colleagues. I have other colleagues in WIP as well. And so and then the Building Technologies Office, Amy Jiron and Eric Werling are responsible for the commercial building and, and the multifamily and residential sector as well and as well as Cedar Blazek in BTO.

So we've got a lot of folks willing to help and eager to help and work with you. So please do reach out you know and again we'll share these slides and recording of this webinar shortly.

I think that's the last. If you want to maybe have a minute left here. Lots of great webinars through the Better Buildings Series. So here's a, here's a calendar if you go to the next slide we'll see what's up, what's on deck. You know Water Efficiency for Multifamily Housing. Multifamily housing is a really important part of the work we do at DOE as well. And so make sure to register for this webinar coming up on September 28th.

Sorry, we're a minute over so I'm going to wrap up here. But there's more resources, including resources on this project that we'll be sharing in other validation work that, that DOE is, is supporting.

So again, I want to thank all of our presenters, Chad, Kevin, Armando, and Guanjing, really great discussion. And I couldn't get to every question, but we'll try to get answers out to some of the others. Please do reach out to, to myself at the bottom there and/or any of us or all of us and we'll make sure to, to get back to you and, and see if we can figure out a way to work together.

So again and thanks to the organizers for this webinar as well. We appreciate the chance to share our story.