Adam Guzzo: Hello and welcome to the 2020-2021 Better Buildings Webinar Series. In this series we are profiling the best practices of Better Buildings Challenge and Alliance Partners and other organizations working to improve energy efficiency in buildings. Next slide. My name is Adam Guzzo. I'll be your moderator for today. We can go to the next slide. I've been with the Department of Energy since 2010 advising state and local governments on strategies to maximize energy and cost savings for energy efficiency and renewable energy technologies programs and policies. More specifically I provide technical assistance on energy data management and serve as the project lead for the State and Local Planning for Energy or SLOPE platform, which is the topic of today's webinar. Next slide.

So here are the items we're going to cover during today's webinar. I'll introduce you to the State and Local Planning for Energy or SLOPE platform, which I'll refer to as SLOPE from here on out. Matt Donath from the city of Milwaukee, Wisconsin will provide some background on Milwaukee's goals and energy planning needs. Next we'll hear from Megan Day from the National Renewable Energy Laboratory and she'll give a SLOPE demonstration and Matt and Megan will show you how SLOPE can be applied specifically in the context of Milwaukee to address some of the questions that they raised in their energy and climate-planning processes. And then finally we'll take your questions and will have what I hope will be a beneficial discussion. Next slide.

So before we dive into the content let me explain a little bit about how we're going to handle Q&A. We'll be using an interactive platform called Slido for both our Q&A and to gather some feedback from you via polls so I'm actually going to launch a poll here in just a minute. So if you could please go to Slido.com either using your mobile device or by opening a new window in your internet browser. And then you'll enter today's event code, which is DOE. And if you'd like to ask our panelists any questions we'd encourage you to submit them anytime throughout the presentation into Slido. We'll be answering your questions near the end of the session. You can select the thumbs up icon for questions that you like, it's a cool feature in Slido, and that'll result in the most popular questions moving to the top of the queue and that's generally where we'll start. Next slide.

So we're going to start things off with a poll so we can learn more about your familiarity with SLOPE. So again please join us over at Slido to respond to these polls and you should see one up on your screen now. Yep, it says how familiar are you with SLOPE? So

thanks for taking a minute to give us some feedback. That'll help us see how much more work we need to do to continue to promote SLOPE in venues like this one. Yeah, so for those of you that are learning about SLOPE for the first time and it appears that's many of you, you're in the right place and hopefully after this webinar you'll better understand what it is and how it can help you meet your energy and climate goals. So again thanks for the feedback. Hopefully you're getting kind of familiar with how this is going to work. We're going to do a couple of these polls throughout our webinar today. So we'll give you another couple of seconds to wrap that up, great. All right, we can go ahead and close that poll and move to the next slide.

Okay, so again the focus of today's presentation is SLOPE. For those, and there are many of you that are not familiar with SLOPE, SLOPE integrates and delivers data on energy efficiency, renewable energy, and coming very soon sustainable transportation into an easy to access online platform to enable data-driven state and local energy planning. SLOPE is a collaboration between 9 US Department of Energy offices and the National Renewable Energy Laboratory or NREL and is designed to support state and local governments and other key energy planning stakeholders in building a 100-percent clean energy economy.

So SLOPE can assist decision-makers in understanding the various cost effective options to meet their clean energy and climate goals. It captures the value of the numerous but dispersed energy data and tools available by increasing awareness of and access to these resources, and then we hope it provides an integrated and easy to use platform, with compelling data visuals to visualizations for users to explore and better understand the impacts of energy actions. So 1 of those data visualizations is the map presented here on this slide. What you're seeing is the technical generation potential for distributed wind mapped by county across the United States. And before we get into a live demonstration of SLOPE I want to give you a flavor of the types of questions SLOPE can answer, how state and local governments are using SLOPE, and the data available in SLOPE so we can go to the next slide for that.

So what are the types of questions SLOPE can answer? Well what's outlined on this slide are just a representative sample of questions that SLOPE can help address. So for example if you're interested in designing targeted programs to reduce energy consumption or energy-related costs in the residential, commercial, and/or industrial sectors SLOPE provides the projected electricity consumption and expenditures for those sectors under a business-

as-usual case out to year 2050 and that data is available at the state, county, and city level. Or perhaps you're interested in encouraging greater investment in development of solar in your jurisdiction so SLOPE provides the technical generation potential of residential and commercial rooftop PV by state and county so you can see how your state or your county compares to jurisdictions in surrounding states or counties. And then we also have similar data for other renewable technologies such as bio-energy, geothermal, wind, and hydropower. And then as I mentioned earlier we're really excited to soon be adding transportation data to SLOPE and that will help answer questions like what could future electricity and fuel consumption and vehicle miles traveled look like under different transportation scenarios. Next slide.

So how are state and local governments using SLOPE? You're going to hear from Milwaukee, Wisconsin in a few minutes about how they're using SLOPE to support their energy planning but here are a few other representative examples from states and a city in a different region of the United States. You can see in the case of New Mexico they're using SLOPE to help guide planning of their Grid Modernization Roadmap Project. Maine is using SLOPE's levelized cost of energy data to augment some professional energy modeling that they've contracted. And the city of Miami, Florida is using SLOPE to inform building efficiency ordinances for renewable energy pilot programs, community outreach and education, and future generation planning in corroboration with its utility. Next slide.

So we're going to look at – and here's a whole picture of all the data available on SLOPE. For the sake of time I'm not going to walk through all the items on this slide. Instead I'll just highlight a few. I already talked about the energy consumption and transportation data. We also have data on energy efficiency including the electricity and fuel savings potential from cost-effective single family home energy improvements and that data is available at the state level. I also noted that SLOPE has data on energy generation and you can see the list of technologies provided here more specifically and some of that data is modeled down to the county level. In addition to the technology-specific data SLOPE has projected electricity generation through 2050 under 12 different scenarios such as low and high demand growth scenarios and that data is available at the state level. And then SLOPE also has projected electricity costs per 16 generation technologies plus battery storage through 2050 and that data is available at the state and county level.

So those are just some highlights of what's on this slide. Beyond what's currently available in SLOPE we're considering developing additional functionality and developing new data this year. So for example we're looking to add scenario planning functionality that would provide users with sector-wide energy emissions and systems cost impacts from various supply and demand side scenarios. We're also looking into how we could incorporate data on environmental justice or energy equity to allow our users to target policies and programs to energy-burdened communities.

So hopefully that gives you a high-level flavor for SLOPE to whet your appetite so to speak. We can go to the next slide. In a bit Megan Day from NREL is going to walk you through a live demonstration. She'll serve you that full course meal to continue the analogy so you can see the full capabilities and functionality of SLOPE, but now it's my pleasure to introduce Matt Donath from the City of Milwaukee, Wisconsin. We can go to the next slide.

Matt coordinates the City of Milwaukee's Energy Reduction Team, which is tasked with reducing energy use and emissions from city buildings, fleet, and operations and Matt also manages the city's other efficiency programs and initiatives including the Better Buildings Challenge for Commercial Buildings, ME2 Residential Energy Efficiency Financing Program, the City of Milwaukee's PACE Program, and the city's Interdepartmental EV Readiness Team. So Matt's going to provide a bit of context on Milwaukee, its energy and climate goals, and some of the questions the city has looked at and how to achieve those goals. With that I'll hand it off to Matt. We can go to the next slide.

Matthew Donath: Thanks Adam. So I just want to provide a little bit of background on the city of Milwaukee. I think it helps provide some context for our goals and some of the strategies we'll discuss later on. So Milwaukee is Wisconsin's largest city and it's actually the 4th largest city in the Great Lakes region. We currently have a population just under 600,000 and it's been holding steady there for a while now. We have a fairly diverse city. Our demographic breakout is 38 percent Black, 38.5 White, 20 percent Hispanic, and 5 percent Asian and this is reflected a lot in our equity goals that we'll discuss later on.

And similar to many other midwestern manufacturing cities we have a fairly old building stock. This statistic is a little outdated but currently about 70 percent of our single family and multi-family units were built before 1955. That percentage might have dropped a little bit more recently but it's still a high number. And then our

commercial and industrial building stock is similarly aged. A lot of our downtown buildings were early 1900s or even pre-1900s. Our city hall for example was built in 1890 and a lot of our municipal buildings are up there in age. And then about 42 percent of housing units are owner-occupied currently, which is slightly above the national average.

And then 1 other thing that tends to come up, especially when we discuss energy planning, is the generation fuel mix from our utility. So currently we're still heavily dependent on fossil fuels with 37 percent from coal and 32 percent from natural gas and only 7 percent from renewables so when we start to discuss looking at greenhouse gas reduction obviously you know this is a big part of it and then also looking at add DDRs to public buildings with private businesses and residences. Next slide.

So for a little bit more background on our office, so the Environmental Sustainability Office was created in 2006 and we launched our first sustainability plan in 2013 called ReFresh Milwaukee. ReFresh Milwaukee had 8 primary issue areas that set 10-year goals that are send to end here in 2023. Those 8 issue areas are buildings, energy, food systems, human capital, land use, mobility, resource recovery, and water. And I think most pertinent for today's discussion are our energy goals so we do have a 25 by '25 goal, which was to have 25 percent of energy used by the municipality to be from renewable resources by 2025 so obviously we have a few years left to get there and the Better Buildings Challenge so we did join the Department of Energy's Better Buildings Challenge and committed to reducing energy use across our building portfolio by 20 percent and then we did take that a step farther and launch a program turning commercial buildings in Milwaukee to also have them reduce their energy by 20 percent. Next slide.

So since our first sustainability plan we're going into another phase of planning. Milwaukee's mayor and common council created the Joint City/County Task Force in Climate Change and Economic Equity in 2019. In 2020 we spent the year doing a greenhouse gas inventory and doing our initial study and what that did was that set our goals for community-wide greenhouse gas reduction. So we currently have a goal of 45 percent greenhouse gas reduction by 2030 and then to be net zero by 2050 or sooner. As we go into 2021 we're going into the next phase of this climate planning process and really what we're trying to answer here is how do we reach the greenhouse gas reduction goals with the folks on equity and local job creation. Next slide.

So as we started trying to answer those goals that's what led us to use the SLOPE platform and this sample of questions here was an example of questions that led us to look into SLOPE more closely and things that we've been able to use the platform for to answer some questions. Next slide.

Adam Guzzo: Thank you Matt. Appreciate that context. That's really helpful and we look forward to hearing from you more here shortly. It's now my pleasure to introduce you to Megan Day. So Megan works at the National Renewable Energy Laboratory and leads research, analysis, and technical assistance on municipal energy planning and policy, utility scale potable tank development, and integrating solar and local land use and zoning codes. She manages the city's Leading Through Energy Analysis and Planning Project, which provides localized energy, data, and analysis for every US city to enable more strategic energy decisions. She's also my counterpart leading the SLOPE project at NREL. So Megan's going to serve you up that 4-course meal on SLOPE; I hope everybody's hungry. And with that, Megan take it away.

Megan Day: Thank you Adam and thanks Matt for being here and walking through this. So quick introduction to SLOPE and then we'll get some back and forth from Matt and we'll see how SLOPE was able to answer some of his questions and apply this data. So to start off with if you're seeing my screen okay here this is the SLOPE platform and we have added a bunch of bells and whistles in response to user feedback over the last year, including a Home and About page to kind of orient you to the platform. There's a lot of data here so we wanted to help folks ease into that. A couple of features I want to point out, just the Home page here is pointing you to the new capability to have your own account, a user account where you can save your settings in default, and there's also a new introductory video so just to give you a little orientation to the platform.

The About page you'll find some frequently asked questions as well as the citations and some information on the data and the courses. So I want to point out here, I get this question a lot, how to create that account with different email accounts. So that's the Home and About page and let's go to the meat of this story here and the Data Viewer has 40 energy data sets here, right, on efficiency, renewables, and coming soon sustainable transportation as Adam mentioned. The layout of SLOPE is basically a description of the data set here with links to all the methodologies and you can dig in as deep as you'd like to get all your questions

answered on how we came up with this data and also some good resources that you can off-rant to.

And then you have an identification of what jurisdiction you're looking at, a time slider for those data sets that have time series data, and you can download all of this data with this button right here. The main visualizations you'll generally see a map and a chart to help you explain what this data is with an interactive data filter, right. It's a legend but it's interactive; you can turn things on and off. I just want to point that out. All right, so Matt why don't you launch into your first question and I'll pull up Milwaukee?

Matthew Donath: All right. So the first question we have is what sector should Milwaukee focus on that will have the biggest impact on reducing our emissions?

Megan Day: Right. All right, so here we are in the data layer that is modeled electricity and natural gas consumption by sector, right. So we're looking at the Coral Plus map here for the county of Milwaukee and you can zoom out and see your consumption in total MMBtus or combined electricity and natural gas across the country. So being a city it's pretty high and we're down here in 2050. So if we look at maybe about 2020 you can see how that Coral Plus map might change over time. Here on the right we have our time series chart, again modeled data for electricity and natural gas consumption by sector.

And so we can see here that the red of a commercial sector is fairly even, a little bit more consumption of natural gas and the residential sector, orange and yellow here, natural gas is orange and yellow is here electricity so we can see that Milwaukee is consuming a bit more natural gas than electricity in terms of MMBtus. So what was instructed to find out for Milwaukee which is common for many other communities that if you change this to dollars spent the opposite is true, quite so, right. So now we have far less dollars spent on natural gas than electricity in the commercial sector and in the residential sector. This yellow line here, band, is the electricity expenditures. So we can see that if Milwaukee is looking to save money for their businesses and their residents electricity is a much more expensive proposition and could really lend itself to energy savings as well as cost savings in both the commercial and the residential sectors.

So I want to make sure we look down to how this compares across the sectors here, so just looking at the data filters and the Coral

Plus map here again is higher because it's a city. So Matt did you – were you able to use that data?

Matthew Donath: Yeah, so we were able to use this in a couple of different ways. So first when we did our greenhouse gas inventory we actually had some issues with the way industrial and commercial were separated so we did get data directly from the utility but they lumped in anything that had a demand charge as an industrial sector. So it was a little bit muddied and this helped us kind of fill in that gap so we could see what we expected our commercial energy use to really be. And then as Megan alluded to, if we're looking at saving electricity – saving cost for residents focusing on electricity savings would be more beneficial, especially if we start talking about the equity impact and lowering energy burden on our residents.

Megan Day: Great, thank you. So we can see here that a lot of expenditures are occurring in the commercial sector. So next we looked at what kinds of commercial buildings are in Milwaukee. So here we can look at the building area by square feet by building type. So we can see that we split this out by the total area of each building so which buildings fall within each threshold, right? This is helpful if you're considering perhaps a building energy ordinance where you're asking commercial buildings to report their energy consumption based on generally those buildings over a certain square footage so you can see how many buildings and what type are over 5,000 square feet versus 50,000. In Milwaukee it doesn't drop that much. There's a lot of large buildings over 50,000 square feet so there's a lot that can be tacked here on the large buildings side and we can see that of this buildings that are 50,000 square feet and higher the largest sector is the multi-family sector in orange there. So again there's a nexus here if you want to be tackling, reducing energy burdens and costs for your residential sector multi-family, large buildings could be potentially included in any kind of approach that you use for commercial buildings. So that's a way to understand your commercial building area as well as count for Milwaukee. Matt, were you able to use that data?

Matthew Donath: Yeah, this was helpful for us in a couple of ways. So 1, it was a little bit surprising to see that so much of our commercial building area was taking up by the largest buildings. We do have a pretty concentrated downtown area that you know we obviously have our largest buildings downtown but it also shows that there's still a pretty high count of small buildings, 5,000 or 10,000 square feet and below. So for us it was helpful to see that knowing that the difference in needs for a program to meet the needs of a building

that's 50,000 square feet or above or 1 that's 5,000 and below we'd have to target those programs very differently. So it was helpful just to see the scale and the spread between these 2 knowing that we're going to have to tailor a program specifically to meet those needs, especially if we start discussing our Better Buildings program and our goal to reduce energy by 20 percent in that sector.

Megan Day: Great, thanks. All right, let's take a look at efficiency to see how we might save some energy in these sectors. So going back up here to energy efficiency we've got 2 main data sets. One is the electricity savings potential by sector and we're going to select the state of Wisconsin, this is the state level data set, and it's modeling out here electricity efficiency savings potential by sector and so here we can see, this is in every study, that the red commercial sector has the highest electricity savings potential with efficiency measures over time. The width of this band is the difference of a zero incentive to a $20 per megawatt hour incentive so we can see that incentives are not making that much of a difference here in the commercial sector; they make more of a difference here in the residential sector here in yellow. So you might want to consider targeting your incentives in that way. So good news for the commercial electricity savings that we saw was a really big part of your electricity expenditures, right, or your energy expenditures overall were high on the commercial electricity side.

I also want to look at the other data sets that we have as far as energy savings potential and this is modeled single-family home energy savings potential across the state of Wisconsin. So here we've modeled all of the buildings that are single-family home detached buildings in the state of Wisconsin and all the different configurations therein and we've only measured those – included those measures that are cost effective with a current positive net present value. And so here we see that on the electricity side in those single-family homes, which even in large cities like Milwaukee tend to be the largest number by far of residential homes are these single-family detached. So LED lighting is going to save you a lot of electricity in Wisconsin as well as upgrading electric furnaces to variable speed heat pumps at wear out so this is a high electricity savings potential as well as upgrading electric water heaters to heat pump water heaters. So even in these cool climates we're finding that heat pumps are really large energy savings measures and then you can also look at fuel savings and here we've got basement wall insulation, smart thermostats, drill and fill wall sheeting, et cetera, so ways to kind of target those most effective energy savings measures for your state. So next question Matt?

Matthew Donath: Yeah, so just going through this data was helpful and with it being at the state level it wasn't as dialed into Milwaukee but it was still helpful, especially on the electricity savings side. On the fuel savings side we know that we have some issues with our building stock because it's so different than the rest of the state. We are an older city; it's going to be different than some of the suburbs and the rural areas. So that led us to looking for another source. We actually went to the LEAD tool to answer this question. We asked as Milwaukee works to meet is energy and climate goals how does the city ensure that the benefits of a clean energy economy are realized by energy-burdened communities and help mitigate racial and economic inequity and how can we ensure that – how can the city ensure that energy costs are not raised for these burdened communities?

Megan Day: Right and so the LEAD tool is a great way to differentiate that building stock as well as tenure renter versus owner-occupied and understand in your city and down to the census track level how that breaks down and where you might be able to target your programs or policies to extend those benefits to your most in-need communities. So here we're looking at the Low income Energy Affordability Data or LEAD tool, right, and again we're looking at a map, Coral Quest map, and a chart. What I'm showing here is the energy burden, the percent of your annual income average for the census track spent on energy and so these are utility bills. So we can see here the darker blue is higher and over 6 percent is considered a high energy burden and if we zoom into Milwaukee here we can see that there are definitely some communities within the city that are experiencing high energy burdens, right? So we can see 6 percent, 8 percent across some of these census tracks. So again a way to target by neighborhood some of your programs and policies.

And let's look just down at the bottom here where I've pulled up a map of your energy burden compared to the state, so this is city compared to state, by tenure renter versus owner-occupied and area median income and here we can see that the highest energy burdens are experienced by those who are living in owner-occupied households in the lowest income group, which is the 0 to 30 percent of area median income and we can pull up a housing count and understand that in Milwaukee we've got almost 10,000 households estimated spending a total of 19 percent of their annual income on average on their electricity and natural gas bills so that's really high. It might be a further way to target those benefits and those incentives onto those folks with most of the need. And

obviously owner-occupied that split incentive is not an issue so that tends to be across the country where you see the highest energy burdens as owner-occupied, lowest income quintile here so that's the LEAD tool. Were you able to use that at all Matt?

Matthew Donath: Yes, this was really helpful for us. Looking at the energy burden data by census track gave us a better feel for which neighborhoods we should be trying to target some of our programs so we currently do have our ME2 program, which is a residential energy efficiency financing program so we've already started targeting specific neighborhoods with communications, working with community groups in those areas to try and get the word out and reach homeowners. And then as we get into the next phase of our climate planning process we're going to be using this data to develop strategies that will most impact these communities. Knowing that equity is such a large part of our plan we just want to make sure that this is addressed because it's obviously a major equity issue.

Megan Day: Right. For those of you in more tribal areas you can map by either county lines here or you can show travel areas and you can see where that energy burden breaks down across tribal boundaries. All right, so that gets us to the next major question for SLOPE. Matt?

Matthew Donath: Yeah, so the third question we had was how much of Milwaukee's energy consumption could be met by locally-generated renewable energy? I mean this was especially important for us looking at some of the goals that we have, so obviously our 25 by '25 goal with a deadline right around the corner here and then also know that if we're going to reach 45 percent reduction by 2030 and 100 percent by 2050 that we'll obviously have to heavily invest in renewable energy.

Megan Day: Right, so this is where we've got some new data that's available and we've modeled it down to the county level for many of these data sets wherever we could. So here we're looking at the county of Milwaukee and this is a Coral Quest Plus Map of the residential rooftop technical potential and so all of these are modeled as technical potential, which is a combination of the resource potential, how much sun is shining in this area, plus the suitability of the in this case rooftop or the land in terms of utility PV. And so it's a combination of the – to give you really a high bound for your planning purposes. You're never going to really achieve this much potential because it means that every rooftop that's suitable for rooftop PV would be built for rooftop PV. It doesn't take into consideration things like the structure and its capability to hold that

weight and who owns it, if it's renter-occupied, et cetera.

So this can really be seen as a very upper bound for planning purposes but we found that residential and commercial PV potential, so this is a logarithmic map or chart here so it doesn't quite look to scale, but combined residential and commercial rooftop PV potential, if you built all of that out and it was a suitable rooftop that only equals about a quarter of Milwaukee's combined electricity consumption, right? So we then looked at okay, what about utility PV? If you built out all of this suitable land area for larger scale PV in the county how would that meet their needs and again it's only about a quarter of their electricity consumption currently as we modeled.

And so that tells us 1 of 2 things, right, that you either need to look at additional renewable technologies if you're going to try to get high penetration renewables or you need to look outside of your county boundaries. So it turns out that with utility-scale PV that Milwaukee obviously we don't assume that you're going to build a larger solar farm in an urbanized area. We're not going to build it out of houses and buildings. So Milwaukee has a lower PV potential than its surrounding counties and so these surrounding counties it turns out could generate over twice as much electricity through utility-scale PV as Milwaukee consumes in electricity. So it's something to look at maybe looking outside your boundaries or other technology and I'll just pull up a couple here.

So distributed wind, Adam showed us earlier there's a lot of potential there. We'll look at the costs later and we'll see why there's not as much distributed wind as well as land-based wind; there is some in the county of Milwaukee and then there is also offshore wind potential in the Great Lakes so that's another potential renewable source. Matt?

Matthew Donath: Yeah, so this was really helpful for us I think definitely in kind of telling the story of how renewables will have to work in Milwaukee. I think there tends to be the thought process from a lot of community members that if we put solar on every rooftop that we're going to be 100 percent renewable and this is a great way to show that and demonstrate it through the graphs and visualizations that was easier to understand so it's a great way for us to communicate that. And then I think looking at the utility-scale side it also shows that we'll have to work with our utility to ensure that we meet our goals. I did show the fuel generation mix earlier so that obviously was relatively low. Knowing that we have all this

potential generation around us I think will lead to more conversations with our utility.

Megan Day: Great. I'm going to show you a couple of more renewable energy generation potentials but here we're modeling, because I want to show you this, it's higher in Milwaukee. You can see here this is geothermal heat pump economic potential so this is ground source heat pump where you're drilling oil under the ground generally to have that heat exchange so it's like an air-source heat pump that you're using the underground temperatures. And so Milwaukee has a very high economic potential as compared to other counties across the country as far as geothermal heat pumps and I also wanted to show you, which was not such a good story for Milwaukee, we have hydropower potential for new stream reach development as well as non-powered dams so these are dams that exist, could have hydropower generation added; unfortunately Milwaukee doesn't have any in their nearby vicinity that could work with maybe some other counties in the state and areas to take advantage of some of that low-cost hydropower potential. So your final question Matt?

Matthew Donath: Yeah, the last question was what renewable technologies are most cost effective in Milwaukee over time?

Megan Day: Great, so here we're going to look at the levelized cost of energy and we'll take a look at it by county, although this data is just fine too. So for the county of Milwaukee, it's going to take us a little while to pull this up here, we mapped out based on the Regional Energy Deployment System Model or ReEDS the estimated cost over time, right? So here we can see through 2050 some of the lowest cost technology in the county is land-based wind if you take advantage of that little bit of generation potential. Currently it's probably gas; that's why we're seeing purple here. We're modeling in the map the lowest cost generation technology and this is in 2020. So hydro is this lighter blue, darker purple in Milwaukee because we saw there wasn't hydro potential is natural gas. But if we look at this out in 2050 by then land-based wind is going to be 1 of the lowest cost technologies in much of the Midwest and hydro remains a low-cost technology and this is generally smaller hydro. We're not talking about major new impoundments and dams and reservoir so we can see land-based wind across much of the country.

And just quickly I'm going to show you the last graph here, this is the levelized cost of saved energy, the program administration cost of using energy efficiency for saving energy. So here's a way to

kind of compare generating new energy versus the cost of saving energy and we can see here that Wisconsin has the lowest cost of the 41 states model for program administration for energy efficiency so it's something that you might definitely want to consider in Wisconsin and Milwaukee. So Matt did you want to summarize this for us?

Matthew Donath: Yeah, absolutely. So this data is all extremely useful for our long-term planning knowing that we have to reach our goal of net zero by 2050. The program administration one was a little surprising to us but it makes sense because we know that our electricity costs are a little bit higher here so if we can focus our efforts with partnering with the utility and doing energy efficiency programs that gives us an opportunity to really make sure that the benefits from these programs are being seen by everybody in our community and again that leads into our focus on equity across our programs.

Megan Day: Great.

Matthew Donath: So then the last slide here was how we envision using SLOPE and how we've used it so far. So we've alluded to some of this in the presentation already but the first way was to use the data to suggest planning prioritization for the Climate Equity Task Force. So as I mentioned we're going through that planning process this year. As we start looking at strategies and programs that we would like to roll out to meet those goals we can use the data and visualizations to help prioritize which programs are going to have the greatest impact. And the second way is to identify building sector type and size that will be most impactful of program priorities so as we looked at building count and building area in Milwaukee that was very helpful for us to kind of break out which sectors we would be able to target to have the most impact on energy reduction as we move forward.

And then a third way that has been useful so far and I think we'll use more in the future is using SLOPE's charts and graphics as a communication tool. So as I mentioned earlier with the rooftop PV it's very helpful to demonstrate the energy change or the mode of energy generation and what we actually need to meet our goals. And with different visualizations and data sets in the tool there's opportunities to do this as well to use it as a communication tool. And then lastly we thought it was very helpful to compare the SLOPE tool to a greenhouse gas inventory, partly to make sure that the data we had was accurate in a greenhouse gas inventory and then it also gave us a little bit of an opportunity to see from the

projections out into 2030, 2040, and 2050. So I think that was a great way for us to use the greenhouse gas inventory in conjunction with the SLOPE tool.

Adam Guzzo: Fantastic. Thank you Matt, thank you Megan both for walking through how to utilize SLOPE and letting us use you so to speak and Milwaukee as a guinea pig to address some specific questions that you raised and I imagine other jurisdictions likely have as they consider what kinds of policies and programs may be necessary to meet their energy and climate goals so thank you both.

At this time we're going to be taking your questions. Again we're going to do that through Slido and I already see there are quite a few in here so if you haven't had a chance yet to populate Slido or up-vote questions that you want to hear from us and us try to address please do so. I'm going to throw a bit of a curveball. I'm going to ask Matt and Megan both to come back on video and we can work through these questions together. While they do that I'm going to throw a bit of a curveball and see Megan if you can pull your screen back up because there are a few questions here as you'll see around what are SLOPE's data sources, how often is the data updated, where we get some of the data that we're utilizing, so I think it would be great if we could show you just where you can get that information directly on SLOPE. So Megan has – Megan showed you earlier the About page and we can point you directly to where you can see for example where are the data sources. So Megan you want to address these and I'll stop talking?

Megan Day: Sure. So lots of data sources on SLOPE and here is a rundown of some of them with links to many of the tools that we use to generate these data sources and the jurisdictionally-resolved data that you see mapped and in charts on SLOPE. So that's a good way to find some of the data as well as I mentioned the data description up here so for each data source and data set we have a link to methodologies, tools, publications, and then other kinds of tools that might be useful to you so lots of ways to link to the data sources on SLOPE. In general we're pulling from a lot of the NREL tools and modeling as well as EPRI, Electric Power Research Institute, and other data sets.

Adam Guzzo: And Megan how often is the data on SLOPE updated? That's 1 of the questions of most interest here to folks.

Megan Day: Sure. So it is updated regularly and it depends on the data set. So let's see, the Regional Energy Deployment System is updated annually based on annual energy outlooks from the Energy

Information Administration and so that will be updated and we've already done a revision of the cost of energy, right, so this is the levelized cost of energy across the country. We're modeling that every year, that's updated every year, as well as the standard scenarios and this is projected generation by technology in different – 12 different scenarios so this is also updated every year. And other data sources are updated as we have the studies renewed and that's kind of an as available question.

Adam Guzzo: Great. And sticking with that theme there was a specific question from 1 of our attendees about where SLOPE gets its data about consumption and potential retrofit for generation options so can you talk about that while you're talking about data sources Megan?

Megan Day: Sure. So this data is built on a model that we ran this models, the electricity and natural gas consumption across the country, we modeled it for every single US city but we did so in a way that looked at a bottom-up/top-down approach so we took the Energy Information Administration's data by state and we modeled energy consumption by census block for the residential sector at least based on the number of households and the type of households and then we true them up so we're modeling for every city, county, and state what this electricity and natural gas consumption plus expenditures are. So it's a model and then we projected it over time in a business-as-usual case based on annual energy outlook projections. So that is a model. It's not going to be you know reflecting minute changes that you're going to accomplished based on programmatic changes. So some people want historic data; the best source for that is generally looking at historic Energy Information Administration data or your own utility will have a lot of that good data.

Adam Guzzo: Let's do 1 more kind of modeling-specific question and then audience get ready we're going to throw another poll at you here in a second. So the next one on the list in terms of popularity, what is the modeling methodology behind energy use predictions at the county level? This is a multi-part question but that's the first part.

Megan Day: Okay, so we're looking at the same data set I'm assuming at the county level.

Adam Guzzo: I think that's a fair assumption.

Megan Day: I think that's what we're getting at so here I described how we did model it at the city, county, and state levels so we're looking at – I'll just grab a county here, again projected by sector, the Energy

Information Administration provides the 861 and 7086 I believe forms and we modeled a different methodology for each sector and you can link to that here and read all about it. It's 41 pages of methodology if you want to dig into that so we use different data sets for each sector to make sure we pulled the most relevant and populated data sets available. So that's how we modeled that and then – the baseline data and then we used a projection methodology that's described here, which looks again basing it on annual energy information projections for a business-as-usual case and that's the process there. I hope that answers the questions. Let me know if there's more parts to that that I missed.

Adam Guzzo: No, you covered that. Then the other elements are asking about the building level analysis or the building portfolio analysis so maybe you can talk a little bit about the single-family home data from ResStock and our CoStar data, which is where we pull our commercial buildings data. It's not clear to me from reading the question which one in particular this person is interested so let's just hit both of them.

Megan Day: Yeah, so this is a great analysis that we did at NREL using – we basically had 350,000 different types, configurations of single-family homes depending on the siding, the roofing, the number of stories, the number of bedrooms, et cetera, and we used super-computing modeling to understand based on different energy efficiency interventions what would be the most cost effective and energy saving potential measures so that's where we came up with these single-family homes energy savings measures that are all cost effective and this is the state-wide savings potential based on each measure. That data also has the individual household savings measure per year if you implemented these cost savings measures.

Then let's look at the CoStar data, so that's based on ResStock modeling and they use things like the RECS, Residential Energy Consumption Survey as well as a wealth of different data sets to understand the building stock and different configurations in each state. The building count and area is based on CoStar, Commercial Real Estate Data and so they collect data on commercial buildings and we're using that purchased data, it's a proprietary data set that's meant for primarily real estate brokers so this is a measured rather than modeled data set. It tends to be better with urban buildings and they miss some of the buildings in the rural areas as a result so just a caveat there.

Adam Guzzo: Thanks Megan. There's a few questions as to what is to be expected around digging into the data set but let's launch second

poll at this point and we'll return back to some questions but we want to ask you a question, our audience. We're interested to learn which data question or questions are top of your mind? So if you could turn your attention to Slido either on your phone or on your internet browser you can select more than 1 option here but we're really interested to hear kind of of these different areas, consumption, efficiency, renewables, cost of energy, generation scenarios, commercial buildings, for those of you who are participating in our webinar today which of these is of greatest interest to you? Which ones are top of mind however you want to frame that? Which are the use cases that are most relevant to you in your jurisdiction?

So efficiency, high up there, I sit in the efficiency pillar at DOE so I'm a little biased. Obviously we think efficiency first and then talk about the value of renewables and other things so that's not a big surprise but good to see that folks are thinking about energy efficiency potential within their jurisdictions. A little bit of a race here between renewables and costs, makes sense. Great, this is really helpful feedback. Well overwhelmingly the majority is efficiency but we can see that quite a few are interested in some of these other data questions that SLOPE can help address so thanks for your feedback.

We can – yeah, let's go ahead and close that poll and I'll turn back to our Q&A here and see kind of what else has risen to the top. Okay, so Megan another one for you, how are delivered fuels handled in SLOPE?

Megan Day: Sure. ResStock does include energy efficiency for fuels, which include all fuels. So if we look at the fuel savings potential we've modeled here fuels including natural gas, propane, bottled gas, as well as – well those are the 2 main fuels here. So definitely delivered gas fuels are included in the ResStock modeling for fuel savings. We were hoping to include propane and heating oil in this modeling but we didn't have enough finally resolved data to do it well so this only includes electricity and natural gas that is piped to the system as a utility.

Adam Guzzo: Great, thank you. And that – I'm just encouraging you audience that we've got a couple more minutes for questions so continue to either like the ones that have already been entered or type in some new questions. There's 1 on energy burden here is the 1 that's the next most popular Megan and I know LEAD is not your particular area of focus. Is there anything that you think you feel equipped to

address here or should we defer this question about energy burden figures and how they're calculated offline?

Megan Day: Sure. I use the LEAD tool a lot and I'm applying it with cities. It does not, if I'm reading this correctly, use the – basically we're just looking at the percentage of your annual income, household annual income spent on utility bills for electricity and natural gas. And so it does not include the capital costs of investing in efficiency measures. We're just trying to model out how the breakdown in demographics and housing type and housing vintages are as far as this energy burden. So we do look at electricity in the darker orange here, natural gas in the lighter orange, and then other would be – I think that would be fuel oil as well as people who are using wood stoves, pellets, et cetera. So that's what the LEAD tool focuses on. As far as 1 thing you might want to look at if you're looking at capital costs for efficiency, this cost of saved energy, what we have here is just the administration cost, it doesn't include the investment cost, but in this report if you want to really nerd out here there is both costs, right.

Adam Guzzo: We're not looking at your screen at the moment so if you want to show us something we can give you control, that's great.

Megan Day: Yeah, sorry about that. So in the report on the program administrative cost of saved energy, that's the last chart that I showed you, if you look in the description of the data and you go to that report there's also data by state on the customer investment costs and what those area added up on top of the program administrative costs. It's a good source for that data.

Adam Guzzo: Yeah and there was a person that was asking specifically about the source for that. I believe it's LD&L in a report that they did a couple of years ago, correct?

Megan Day: Correct.

Adam Guzzo: Okay. All right, I think we've probably got time for maybe 1 more question here. One that just popped up, it's a little further down the list but I think it's a good one – well, let's see if we can hit both of these at the same time. Does SLOPE include storage systems for PV and wind? We referenced the battery storage part but can you talk about that a little bit more Megan?

Megan Day: Sure. In the levelized cost of energy there is a battery storage capital cost model, right, that shows the precipitous drop in those capital costs for battery storage based on I believe it's a 4-hour,

lithium ion battery kind of model. So capital costs are definitely included in there as well as storage is included in the standard scenario for generation over time so there's a storage component that their modeling will be incorporated into the grid over time in each state so that's something to look for as well on storage.

Adam Guzzo: Thank you Megan. So that's all the time we have unfortunately for questions. Thank you for these questions. If you have more SLOPE-specific questions I know we weren't able to get to all of them but you can certainly feel free to email us at slope@nrel.gov or you can reach out to any of us that presented today. We're happy to answer any further questions and our contact information is provided at the end of the presentation. So thanks Matt and Megan again for your time today sharing your insights, your experience, and really your thoughtful responses to a lot of these great questions Megan. Thanks for addressing many of those.

So as we move toward the finish line here we want to make you aware of some other resources and upcoming events that may be of interest so don't leave just yet. And before we do that we have 2 last polls to gather some additional input from you that will help us ensure that SLOPE continues to be a valuable platform to you. So we're going to turn to Slido here, keeping our folks running the webinar on their toes, and you should see how do you envision using SLOPE as the next poll question that we'd like to get some intel from our audience.

Got it. So folks are still not quite sure yet, obviously that makes sense as you're still getting familiar with the platform. Hopefully after today's presentation you feel more comfortable with it and will have an opportunity to dive in and use it a bit. City energy planning, great. It looks like we've got some states as well as multi-jurisdictional research of interest. We'll give folks a couple more seconds to fill that out and then we will hit you with 1 final poll and this next poll will actually try to get your input on some other features and data that you'd like to see in SLOPE so this will be a freeform option here next.

You can go ahead and close that poll and let's launch the last one. So how do you envision using – or excuse me, what additional features or data would you like to see incorporated on SLOPE in the future? So again this is an opportunity just to write in things that you would be – be helpful to see. I mentioned earlier that we're looking at some scenario planning functionality as well as how we might incorporate environmental justice or equity metrics into SLOPE. I imagine some or both of those would be very

helpful. More granular, city-level data sets. Yep, we certainly hear that. We have quite a few but we know that that's an area where there's great interest. End of life housing stock replacement, okay. Another vote for more city-level data, okay. I see people are interested in the transportation data that we're going to have coming out and wanting to see more of that. Climate data, demographic data, this is really helpful feedback. Thank you for folks who are offering some input.

In a minute here we're going to talk about some additional resources but there are going to be some opportunities on March 30th and April 8th to actually go through this on some webinars that we're going to host. So let's go back to the slides and folks can continue to fill out that poll if they'd like to but I want to highlight a few things for you here quickly because I know we're up against time. So here's some additional resources, I mentioned some webinars. A lot of these resources were referenced during the webinar today. You can go to the next slide.

We're also excited to announce registration for the 2021 Better Buildings Better Plants Summit. That's open. You can see it's going to be May 17th through the 20th, a lot of engaging, interactive sessions so we encourage you to sign up for that. Next slide. This is just 1 part of the 2020-2021 webinar series. We've got a lot of great presentations through April so I would encourage you to look out for more of those. Our next webinar on the next slide is actually entitled, "You Have a Data Center – Now What?" so we're going to discuss how you can leverage energy efficiency to streamline operations, cut operating costs, and increase data center resiliency so I encourage you to join us for that.

On the next slide we are highlighting a new workforce development portal. This is where you can get resources, information, training, education, and job opportunities that can help take the next step towards a career in efficiency. So if that's of interest to you or sharing those resources with those in your jurisdiction I encourage you to check out that workforce portal. On the next slide we're going to showcase where you can go back and watch recordings from this webinar once it's posted, other webinars you've done in the past, presentations from our summits, so I encourage you to take a look at that for more resources and more webinars.

And then with that I'd like to thank our panelists again for taking the time to be with us today. Again here's our contact information so feel free to reach out to us with any questions we couldn't

answer today. And you will receive an email notice when the archive of this session is available on the Better Buildings Solutions Center and in the meantime if you're not already doing so I encourage you to follow the Better Buildings Initiative on Twitter for all of the latest news. So with that I'll say thank you to everyone. Have a great rest of your day and week and we hope to see you at a future webinar. Take care.

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