Bruce Lung: Hello and welcome everyone to the 2022 Better Buildings Seminar Webinar Series. We are dedicated to bringing you the latest actionable insights from leading industry experts, and this is an annual series and it's a chance to explore the topics, technologies and trends that affect your organization as well as efforts to accelerate energy efficiency adoption within society. Before we dive in, there are a few housekeeping points that I'd like to cover. Please note that today's webinar will be recorded and archived on the Better Buildings Solutions Center.

We will follow up when today's recording and slides are made available for each of you. Next thing, attendees are in listen-only mode. This means that your microphones are muted. If you experience any audio or visual issues throughout the webinar, please send a message to the Q&A box located at the bottom of your Zoom panel. My name is Bruce Lung, and I'll be your moderator.

I've been working on industrial energy efficiency since the late 1990s and supporting the DOE's Better Plants Program here at the DOE since 2015. Today's topic is a very important one and one that doesn't always get as much attention as it deserves. Demand response, particularly automated demand response and demand response industrial facilities, the idea behind the demand response is something that started a long time ago, probably in the 1990s from the utility sector, and basically to prevent from having to bring additional generation capacity online during periods of high electric demand. Power plants and utility companies started a process where they could enter into agreements with their commercial and industrial customers to reduce those customers' electricity demand at peak demand times.

There are a variety of demand response programs available to both industrial, commercial and residential end users today. And in today's webinar, we'll be discussing some technical resources, especially a new document that we generated on demand response programs in manufacturing, but we'll also provide two compelling partner examples of how to leverage demand response to maximize the benefits to their respective organizations. The demand response in industrial facilities peak electric demand is a document that I just referenced, and there's a link to it in the chat box right now. This document offers actionable insights into demand response programs, various electricity rates, and ways you can benefit from participating in your utility demand response program if they offer them.

In addition, we will have the lead author as one of our presenters, so hopefully you'll get a lot of out that. On slide five, the Slido instructions today. We will be using an interactive platform for question and answers, polling and feedback. It's called Slido. Please go to www.slido.com on your mobile device or computer and open a new window in your internet browser.

Today's event code is #DOE in capital letters. If you would like to ask our panelists questions, please submit them any time throughout the presentation. We will be answering the questions near the end of the session through the Slido. You can also select the thumbs up icon for questions that you like, which will result in the most popular questions moving to the top of the queue. Also this is in Slido.

So before we get started, we want to learn a little bit more about you. So we're going to start off with a few polls. Please join us over at Slido to respond to the following questions. If you're having any issues, please message our tech support team by using the Zoom Q&A function. So the first poll we have is who is responsible for participating in demand response programs for your organization?

[No conversation from 0:03:54 to 0:04:16]

We'll give folks a few more seconds before we close the poll. I like that, nobody. Okay. Well it look as though we've gotten a good number of responses, and it's interesting that a lot of folks have chosen the energy manager. We found that this can sometimes be the purview of somebody else within the organization, so it's also the case as you can see from these answers right here.

I think we'll go ahead and finish this poll and start with the next one. And the second question is what technologies have you or your colleagues leveraged to maximize the benefits of demand response for your organization? This is again a word cloud.

[No conversation from 0:05:17 to 0:05:45]

We're getting some good responses here. Okay. We'll give folks just a few more seconds. This looks like there's quite a variety of strategies and technologies here. Okay. I think we've got a pretty group of technologies here. Thank you all very much for participating in these two polls real quick.

Next, I'm going to go ahead and start introducing the speakers. I'll go ahead and introduce one at a time, and then if you can save the questions for the end we'll get to those at the end. Our first speaker today is Paulomi Nandy from the Oak Ridge National Laboratory. Paulomi is engaged in DOE's Better Climate Challenge, Better Plants Program. She helps develop resources and tools for greenhouse gas accounting and also helping Better Plants Partners develop decompensation roadmaps.

Paulomi is also a technical account manager in the Better Plants Program, and she is a lead author of the Demand Response Documents, so I hope you'll get a chance to view that document. And now I'll turn it over to Paulomi.

Paulomi Nandy: Good morning, everybody. Thank you, Bruce, for the introduction. Next slide please. If you can go to the next slide. Okay. Using this guide, as Bruce mentioned, that I have made with my colleagues, Thomas Wenning and Alex Botts, have developed this resource for our industrial partners specifically.

So peak demand management is usually very – peak demand charges for industrial facilities is usually very high. Every industrial facility in some way or the other can deploy some form of demand management to help curtail their peak demand charges. So in this guide, basically we kind of explored the different time varying rates that are available from your utility provider, understand how you can use different strategies to kind of deploy demand management responses in your facility, and then also I have a couple of case studies that we have asked our partners to share with us as part of this guide. Next slide please.

So let me jump into things and talk a little bit about how electricity is generated. Electricity, as we know, is generated from different sources. It can be fossil fuel or renewable energy. Because there is no capacity on the grid to store this electricity when it's generated, it's always generated and directly distributed to the customers. For these purposes there are different baseload and peak load plans. Baseload plans are there.

Basically they're operating all the time. And peak loads come online when there is a higher load demand on the grid. So the basic idea is basically for the facility to start thinking about how to reduce their peak during these peak hours. Next slide please. Again, quickly going over just a general understanding of electric consumption and electric demand, electric consumption is total electricity that's consumed in a facility, while electric demand is

the rate at which electricity is consumed. As you can see in this figure here, two of the different times during the day, the number of lights that are turned on, and during 12:00 PM in this graph you can see all the lights are turned on.

So basically for this case the electric demand for this facility, if you might say, is 500 kilowatts, whereas the total energy consumption is 1.8 kilowatt hours. Next slide please. So as I mentioned, all facilities can take part in the response in some way or the other. For some it might be easier, some it might be a little more difficult depending on how they operate and the flexibility of their production. Candidates who have more flexibility in the production schedule and process timing, they are much easier candidates and they can easily deploy some form of demand response, whereas facilities who are continuously near their processing capacity and have higher volumes of production it's difficult for them to do DR response.

But there are still some strategies they can still use to kind of help them curtail the demand charges. Next slide. There are two different types of demand response, seasonal demand and daily demand. Seasonal demand varies more with the weather patterns in the United States. So here you can see in the summer, and I know the fonts are very small but you get the slide deck so you can see it later, but in summer basically you have a higher peak during the day when the cooling requirements are higher on the grid, whereas the winter peak is slightly lower because winter demands are mostly driven by natural gas usage.

Whereas the daily demand, it's very specific to an individual facility. Here, for example, you have a graph here showing a customer example, a customer facility where the peak demand is around 640 kilowatts during the early hours of the day. It slowly ramps up, and then during the day around afternoon it reaches its highest peak, and then during the later evenings the load slowly ramps down. The average load for this facility is around 210 kilowatt hours.

So you can see there is a change by change in the average load that you have and then the maximum load, which is your peak demand. Next slide please. Jumping in a little bit of time varying rates, there are different time varying rates that are available from your local utility provider. Some of them I have mentioned here. So time of use pricing, this is basically a rate structure depending on on-peak and off-peak hours. This is predetermined by your local utility, and

usually during the afternoons you would see a higher charge depending on where you are located in the United States.

The bill volatility and the savings you can also see are marked by those stars. The lower number of stars shows lower volatility and savings, while the more number of stars shows higher change in that. The next one is peak time rebate. It's basically customers get a rebate when they reduce their load when there is a higher peak on the grid. Bill volatility for this is none because customers have very low – they don't get penalized being part of this and they have higher savings.

Critical peak pricing is similar to time of use pricing, but the cost during that hour is slightly higher than what you would expect for time of use pricing. Next slide please. Coincidental to peak demand is something that customers in ERCOT or PGM should be a little more cognizant about. This is basically when the facility is at the same time peaking when the grid in that area is peaking as well. So during those hours, during the summer months is usually when this happens and customers should be cognizant and think about how to curtail the load during those summer hours.

These charges can be really, really high than your normal time of use pricing or other pricing schemes. Available peak pricing is basically similar to time of use pricing, but basically what happens is the cost varies during even those hours. It's not a constant cost. Real-time pricing, it's literally a dynamic pricing rate where it almost mirrors what the rate structure is in the wholesale electric market. Next slide please.

Demand response strategy. What are some of the strategies that you can use in your facility? So basically this shows an example facility where you have different areas inside your facility. So you have office spaces, critical operation areas, shop floors, warehouses, as well as equipment room and office spaces. So you can use basically manual adjustments to kind of change the setpoints, things like that to kind of help you manage that demand, or you can use occupancy sensors or your BMS system, Building Management System, which can help you kind of curtail that load.

Your BMS system basically would get inputs from based on weather, utility demand, even how much renewable you are producing onsite. Those would feed into how you would basically manage your load inside your facility. This would be something that you would do at a daily basis, so it would be a continuous demand management. Say, for example, you get an event that is

triggered on your grid and you get a notification from your utility provider or third party who is help you kind of manage your demand response program. You can go ahead and can manually adjust these setpoints or you can turn off equipment that are not critical for your operation.

So that would be something that you would do for an event-driven event. Next slide please. Here we talk a little bit about the hierarchy of demand response. Hierarchy is organized by a method which will give you the greatest impact on your facility's demand requirements. Eliminating load would be most drastic to reduce load from the grid. The next would be reducing your load through energy efficiency or other base, moving your load or substituting your load.

As you eliminate your load you get the highest load adjustment, whereas if you put generation you have the highest growth potential. Next slide please. Energy efficient – so here we kind of go into demand management strategies, so load shifting, shedding and generation. Shifting would be either using storage, shifting cooling loads, shifting equipment charging. Load shedding would be again HVAC setbacks, dimming lights, turning off plug loads. On generation, you can have onsite generation either through combined heat and power, onsite renewables, something like that.

Next slide please. Automated demand management. As more and more market becomes wider for Internet of Things advanced building management system, this has become more and more something that customers are slowly looking into where they use automated demand management to help them curtail that load. They use a third-party provider to help them kind of also identify where they can curtail some of their loads during peak demand. Next slide please.

Finally, I want to talk a little bit about the case studies that we found from our partners that they did. The first one is Cleveland-Cliffs where they had partnered with their curtailment service provider and had committed to reduce their peak load between 30 to 120 minutes, basically getting a heads up before and based on what production and schedule and hours of the day, basically curtailed their loads. The next one is Agropur.

They have been taking part in electric and natural gas demand response program for over 14 years. When they get notified about an event that's happening on the grid, what they do is they basically go out and manually adjust their setpoints, turn off

equipment to kind of curtail their load. I think that's my last slide. Back to you, Bruce.

Here's the link to the document, and I think it's in the chat as well. If you have any questions, feel free to reach out to either me, Bruce or Alex, who's also an author for this document.

Bruce Lung: Great. Thanks, Paulomi. Just to make sure everyone realizes, these are not future webinars. These are just the link to the document and the people who worked on that demand response document. Well next I'll go and introduce our next speaker. It's Jesse Tootell, who is a Senior Manager of Energy Analytics at Lineage Logistics, which is the world's largest and most innovative temperature control and industrial real estate investments trust and logistics solutions provider.

In this role, Jesse works on optimizing Lineage's energy portfolio with an emphasis on new technology, development and energy market strategy for the company's 400-plus sites across the globe. As part of the R&D team, Jesse has shared multiple awards and patents for work on novel R&D initiatives, including the US DOE Better Practice Award for the last four consecutive years. I should point out that Lineage Logistics is also a Better Plants Challenge Partner, so we've definitely learned a lot from them and they've leveraged some technical assistance from us. So Jesse, take it away please.

Jesse Tootell: Thanks, Bruce. Hi, everyone. Thanks for joining today. I'll start off on the next slide here with just a brief introduction – sorry, next slide, one more – into who Lineage is.

So we're essentially the time machine for the cold storage food chain. There's a big timeline between when food is grown or produced, you know, meat, poultry, agriculture, whatever it is, and when it gets distributed to grocery stores and consumed by families, and that's when it enters the Lineage part of the supply chain. We store our food at various temperatures, typically below zero degrees Fahrenheit, and keep it safe and ready to eat whenever it's needed during whatever time of year people consume it. Next slide.

As Bruce mentioned, we have over 400 sites and now I think over 21 countries. This is slightly outdated. We continue to grow. Just to give you an idea of our footprint. Today I'll be focusing on our US efforts regarding demand response. Next slide.

I'll briefly touch on this just so everybody understands. You know, Bruce kind of mentioned it. We like to leverage technology analytics. We have an applied science team, which is growing pretty steadily throughout the years. That's where I sit on the research development side. That touches every aspect of our business, including labor and transportation optimization. But just to set the context for today's talk, that's kind of the skew that I bring to my perspective on energy, and I just encourage everyone here to embrace the power of data-driven decision-making, data availability.

I've got a couple of examples of how we've managed to leverage that over time. Next slide. So the reason we can have a data science team is because we lash our value to the cash flow of the company. So for us, you know, we're looking at the top equation here. It's pretty simple how our business operates.

We provide various services, typically cold storage, at a given price. So it's the price we can charge for a service times the number of times we can do that service minus our two biggest cost centers, which are labor and power, and EBITDA here represents our net profit essentially. And then within power, you know, how we think about power cost, it's just like driving a car. We have a certain amount of thermal work we need to get done.

That's heat removed from the product and from the room. That's the number of miles we have to drive on a road trip. Then we have how efficiently are we using gas? How efficiently are we using the kilowatts electrical that we draw from the grid or any other generation source to achieve that kilowatts thermal work just like miles per gallon. And then what are we paying for gas?

And for us in energy that's how are we procuring energy if we have a choice in the deregulated market, for example, and when are we procuring it? So, you know, Paulomi touched on hourly differences in the price and the effect that has. Last year we signed the Climate Pledge, so now we have an additional kind of objective here where instead of power costs we're also looking at emissions. And really the only thing that changes here is carbon in that last bit there replacing price.

To Paulomi's point, it's nice that these things tend to be aligned. They're not always aligned, but there's a high correlation between the price you're being asked to pay and the carbon emissions of that generation source. When the grid is most stressed out the price is highest, and then as you reduce – at that point you're saving

money but you're also incentivizing the grid to not use high-emission sources and you can reduce your carbon footprint. Next slide please.

So we have examples. This is kind of going through the demand response hierarchy that Paulomi mentioned. For the sake of time we'll just discuss two sections here, the schedule section and demand response. Next slide please. Specifically scheduling, talking about shedding and shifting, load shedding and shifting part of that mechanism.

So cold storage is somewhat unique, and this won't apply to everyone, but this is the use case that we developed pretty early on, the industry standard for cold storage – and again, keeping food below zero degrees Fahrenheit here – is a thermostat control system. So when the building gets a little too warm for comfort you click the giant refrigeration system on, which uses about 80 percent of the power in a given site on average. And as it gets cold enough you turn it back off until you have this kind of on/off control.

So you're using relatively consistent power throughout the day despite there being inconsistent prices throughout the day. And so you end up paying more for the power during peak hours. So this concept of thermal fly wheeling that we developed is pretty intuitive, right? You use power when it's cheap and you don't use power when it's more expensive, and there's a lot that goes into developing that ability to do that, but that's the basic concept. Next slide please.

This slide, without going into too much detail here, the thing to stress here is to figure out how your building reacts when you do things to it, when you turn it off, if you – Paulomi mentioned there are certain businesses that are well designed for demand response. We happen to be one of them. But understanding the impact to your processes, to your production, to building load, that's all critical. And for us, modeling out our building reacted generated some pretty significant insights.

So the line is what we predicted would happen here when we cooled for 15 hours and then just let it warm for eight hours, and you can see that fit exactly with the datapoints we actually collected, and the insight here is that we have a giant thermal battery. Cold storage is the giant – the biggest thermal battery in the entire world, and this looks exactly like a battery charging during the cooling period and then heating up during the warm

period. We can leverage that – next slide please – to actually kind of control our load in a very mathematically rigorous way, right?

So this is where we get into a little bit of that data analytics and optimization through a lot of stuff that I'd be happy to go into. We can kind of optimize based on what we know about the energy pricing how we use power. So this is a load-shedding example. Here we have on the time plot, the power that the site is using at the compressors, and that's again a large proportion of how much energy we use. And then you have the usage rate in dollars per kilowatt hour in the bottom panel. You can see we're dropping load.

This is the earliest example. This happened in 2018. Dropping load when the prices are increasing, increasing load when the prices are dropping. And this is also a demand mitigation effort because we don't want to spike a new demand charge as we recover from those load periods, and so it's a bit of shedding and shifting. Next slide please.

One of the other highest energy processes we use is blast freezing. So warm food comes in from the field or wherever it's produced – for example, gallons of strawberries – and we have to freeze it from ambient 70 degrees Fahrenheit down to zero degrees Fahrenheit, and so we just put it in this big essentially closed room box with a bunch of pallets and just turn this thing on until it's frozen. Next slide please. And one of the biggest insights we had was how we can control that process.

Here you can have a simulation of a box of food surrounded by a layer of air freezing over time, and there's a physicist on our team so that's why it's in Kelvin, but the green spot is frozen, essentially. This process typically, which is on, like I said, until it's done, and that's typically anywhere between 24 and 72 hours. What we've been able to do is leverage the ability to simulate how the food responds and accurately measure how the food responds in testing to pulse that process.

So we can achieve very similar results on very similar timeframes, but without the extreme energy usage that that process uses, and so we can leverage that for demand response, we can leverage that for just kind of peak demand management as well. Next slide please. Now onto demand response specifically and responding to the grid. Next slide please.

Here's some summary statistics of how our company does this in the US over the last couple of years. I'll spend a little time on this

to let everybody digest in these numbers. From 2020 to 2021, again, these seasons run from June to May in the vast majority of markets. That's why it's organized that way. We've gone from 47 sites enrolled without about 30 megawatts of demand response availability up to 99 sites that we're planning for this coming year, which just stared this month, and over 74 megawatts.

So this is a growing market for us. We participate in pretty much every market we can with our 200-plus sites that we have in the US. We still have more enrollments to make in the coming years, and some of these states don't have response programs for various reasons. But we're in 16 states and this is our current footprint. Some estimates of carbon reduction. These actually should be higher because it's using average offsets of the grid, and when demand response occurs that's typically higher emission energy sources.

But you can see that you have a pretty major impact when you actually reduce load on the scale. So I just wanted to briefly talk about some of the factors. We participate in a lot of different programs, and I kind of am going to focus on going forward how easy they are to do, what it takes to get them done, and then a few things to just consider for yourselves. Is it a manual response program? Are you sending an email, a call, someone onsite is kind of turning knobs and doing this themselves?

Preset is the way we kind of think about it. Some people refer to that as automated, but really that's just a protocol in your control system where they can press a button and then hit a preset schedule ramped down procedure in order to achieve demand respond goals. And then automated. Automated to us means without having the manual intervention of someone at the site actually initiate the shutdown. That's something that I'll get into in a moment.

And then some other things that Paulomi touched on. You know, how much notice do you get ahead of time, how often are these going to occur, and how much time do you have to respond once these events are called are all really important factors in terms of deciding which kinds of programs you're actually going to be in. Next slide please. So I'll start with the manual.

One of the ways that we have had success with manual response, meaning that the site level guys are getting some sort of notification and they're the ones manually managing load down for a demand response event, it's just through data availability. I saw a lot of you in the poll said submetering and kind of that just aligns

with data visibility. That's kind of a prerequisite for this in my opinion. If you can understand what your load is then you can manage your load, right?

It's a measure to manage problem. So we have things like this dashboard on the left where we're showing what the load is for the different compressors in the building at the main services, and then expected price in the day ahead or account market. That's not what we actually experience, but it's an indicator. Then there's also these automated alerts that we send out to people, right?

Typically the high price hours are indicative of bridge stress. That's a potential time you might have a demand response issue come up. Next slide please. This is an example that I don't have a ton of time to go into, but essentially on the top plot here you have an additional opportunity of when you do demand response events you have an energy arbitrage opportunity. Here we have the power that the facility's using in black and those dash lines on the vertical are demand response events.

We have these hedges, and it's a deregulated market where you're procuring power ahead of time at a fixed contract price and deregulated markets. When you drop load below those hedges, as you can see that's highlighted in the green in that plot, you're liquidating that unused hedge back to the market. So when we're responding to these demand response in vertical dash lines, we're also selling back unused energy at a big arbitrage opportunity. So there's lots of ways to kind of align incentives and value stack at this programs, and that's kind of just what I'm showing here.

Next slide please. I can come back to this later in the questions if we have more time. The last thing is controls in wrapping up on this. This is called the Atlas Platform. It's by a company called CrossnoKaye, and this is how you get to actually automated demand response, where you have inputs coming from the market passively, price inputs, any preprogrammed response that you want, and this can automatically achieve that demand response in your facility without the guy having to go pressing a button and without the guy actually having to go turn knobs.

Next slide please. Next slide please. Skip this one since we're out of time here. And then this is just kind of how we do the future of it, right? This is all the inputs into a single facility that we might have.

This is our future state where we have any onsite generation on the left, battery storage, all the market signals and thermal state of your building, and this is all just going into a big optimization blender, and ideally this is an automated process for us going forward. And that's it. Next slide please and I'm done.

Bruce Lung: Great. Well thanks a lot, Jesse. That was really interesting. I particularly liked the way that you got EV and onsite generation in this last diagram, because that may be one of the things that can help with the demand response, is that if you can have more insulation at the height of the day from solar that can reduce the load for the utility. Anyway, next slide please. I'm going to introduce our third speaker.

Today we have Joe Benyon. Joe is a mechanical engineer with the Los Angeles Department of Water and Power. He is also a Better Plants Challenge Partner. Joe is currently the supervisor of Water Operations, Pumps and Wells Metro Group and Engineering Group within LADWP that oversees capital improvements and maintenance activities at the 49 pumping stations across the Los Angeles metro area. One other interesting thing about LADWP is that they're a municipal utility, so the water division actually buys power from the power division and so forth so there may be a little play there. Joe, go ahead and take it away. Thanks.

Joe Benyon: All right. Thank you, Bruce. Good morning, everyone. Yeah, so as Bruce mentioned, my name's Joe Benyon. I'm a mechanical engineer within the Los Angeles Department of Water and Power.

Next slide please. And today I'm going to talk about how our water system operations contribute to our grid support. Next slide please. As Bruce mentioned, we are a municipal utility. We're actually the nation's largest. We consist of a power system and a water system. So the water system does end up purchasing water from itself, from its brother, and so we provide water and power services to over 4 million residences and businesses in the city of Los Angeles.

We have over an 8,000 megawatt electric capacity on our power side. On our water side, we supply 435 million gallons of water to customers each and every day. Our service territory is the entire city of Los Angeles, which spans approximately 465 square miles, and to provide water and power to all those people and to businesses we employ over 11,000 people. So we originally began serving water to Angelinos in 1902 via the Los Angeles Aqueduct.

This is a 334-milelong aqueduct that was kind of an engineering and surveying feat at the time because its designer, William Mulholland, designed it to be entirely gravity-fed, which pulls water from the upper Owens Valley along the Eastern Sierra and brings it all the way down to LA without a single pump. So we're designed even over 100 years ago to be as efficient as possible. A few years later, Ezra Scattergood worked with William Mulholland to open the first power plant along Los Angeles Aqueduct and began supplying power to LA in 1916.

Next slide please. To talk a little bit more about our water system, you can see at the bottom of the slide we actually provide water from our source water. We treat it, distribute it, pump it, and then ultimately it goes to our customers. So we have a diverse water supply portfolio that consists of water from our LA Aqueduct, purchased water from the State Water Project in Colorado River Aqueduct, and we also produce groundwater from our groundwater basin.

We own and operate all of our horizontal and vertical assets involved in delivering potable water to our customers, and since we span over 465 square miles we have multiple pressure zones, 113 to be exact, to provide this sufficient pressure for our customers and for fire protection purposes. To support these zones, we have 86 pump stations, which I oversee I think 49 of them. We have 325 regulating stations, 120 tanks and reservoirs for water storage, and 35 treatment facilities across the city.

We also have a huge distribution network of 7,300 miles of distribution mains to provide water to all of our customers. Our main mission within the water system is to provide our customers with reliable, high-quality, competitively-priced water in a safe and environmentally-responsible manner. That's where demand response comes in, because we want to be environmentally responsible in our own production but also in helping our power system shed loads as much as possible and avoid turning on peaking plants during high-demand times. Next slide please.

So our entire demand response program is built off of how our system operates with our system presser zones. We designed our water system to be as efficient as possible. So we use our topography to our advantage and try to move water from zone to zone with our reg stations that operate primarily off of hydraulics and consumes minimal power when in operation. So our demand response program targets energy-intensive facilities like our pump

stations. So we have two primary types of pumping strategies within our system.

We have closed system pumping and tank storage. Closed system pumping is ideal for smaller service areas with low water demand. These areas typically use small pneumatic tanks or VFD driven pumps to maintain pressure in these zones. It means with low storage these pumps are in continuous operation, so they're not really a good candidate for demand response. Our second supply strategy is tank storage.

The majority of our system zones are supplied by one or more tanks or reservoirs, and those reservoirs provide plenty of capacity to meet our large demands over hours of time and meet fire flow requirements. To fill these tanks, we utilize pump stations to pump water from lower system zones to higher ones. Once a tank is full the pump shuts off and remains off until the tank needs to be refilled. We call this type of operation block flow. Stations that operate in block flow are ideal candidates for our demand response program.

Next slide please. So our water system began participating in demand response program back in 2016. Our goal was to reduce demand of our generating stations during peak times of the day on the hottest days of the year. As you're probably aware, Southern California keeps getting hotter and there's more fire, so we're trying to be as economically and environmentally responsible as possible, so we want to make sure we shed those peak loads as much as possible. So during our 2016 benchmark, our Water Control Group determined that 17 of our pump stations in over 20 pressure zones could actually provide enough storage to be able to not operate during those peak times.

So our demand response manager providers 24 hours of notification to us of a demand response event that typically lasts anywhere from two to six hours and requests our participation. At that point, we normally comply and say that we're going to be participating, and our water control group and our operators fill our tanks and reservoirs to maximum capacity on off-peak hours so that we have sufficient capacity to meet our water demand – I'm using demand a lot – but our water demand during this peak time, and that way we don't have to run our peaking plants on the power side to run our pump stations. So that being said, our primary goal on the water system is to provide water to our customers and for fire protection.

So in the event of an emergency, our demand response program is flexible enough that it sort of allows us to start pumping during those response periods just in case there's an emergency so that we can ensure that we continue to provide water to everyone in need. That being said, that rarely happens, so we're able to comply and leave our stations off the majority of the time. And just as a quick fun fact, our water control group and our operations has been doing a form of demand response for years, even before we began participating in 2016.

Our controls group looks at the system, and any hot day we typically try to crowd our tanks before the peak heat just to make sure that we have enough water in our tanks for emergencies and for fires. Next slide please. So just to get to a little bit of the results from the data that we've collected for the last three years, we aim to offset 4,000 kilowatts per event to support our power system, and our data has shown that we average offsetting 7,100 kilowatts per event, which far exceeds our commitment each year.

We have found that we have shifted over 388,000 kilowatt hours of energy overall in the last three years and avoided over 100,000 pounds of CO2 emissions by reducing a need for our power system to run peaking plants during our hottest days, which results in about a 27 percent emissions reduction. So that does it for my presentation. Thank you.

Bruce Lung: Thanks a lot, Joe. That was a very good presentation, and hopefully folks got some good ideas and insights out of it. Next we will turn to the Q&A portion of today's webinar. So I want to thank all of our panelists, and if you haven't done so already, just a quick reminder to join us over at www.Slido.com. Use that code #DOE to submit any questions.

I believe we have questions here. Okay, great. So the first one that has 4 likes is that there's been a big push for electrification for carbon reduction. Do you think these programs will become more prevalent as we force more load onto the grid?

Is this something that we should focus our efforts on before we electrify? I will let any one of the panelists start with that. Paulomi, maybe you want to take it on or Jesse?

Paulomi Nandy: Sure. I can take a quick stab at that. So I think yes, with more and more push for electrification, more and more facilities are starting to think about their capacity, think about how they're going to tackle that demand. It would be a good time to start discussing that

internally as well as with your local utility provider and see what kind of different programs that they have and what you can leverage as well.

Jesse Tootell: And I'll just tack on there, you know, we're getting a big push now especially in Southern California for a lot of the trucks and the refrigeration units on those trucks that are on our sites. That's something we're actively pursuing. I think that the best way to think about it is an incentive now is likely to be a penalty later, right? The regulation will continue to move forward, and I think a lot of other states will follow California's lead on that front.

Bruce Lung: I'll go ahead and ask Paulomi to address the question that was directly addressed to here her. Can you touch more on the NG demand response program?

Paulomi Nandy: Sure. So in my paper, a resource that we developed mostly kind of focuses on electricity, but there is natural gas demand response as well if you are located in colder regions like Minnesota or say Northeast America somewhere. There are natural gas demand response as well where during winters you are kind of called upon to reduce your natural gas loads, as I have briefly touched on, like Agropur was doing where they had to reduce – because they were located in Minnesota, they had to reduce their natural gas usage during those hours.

It's not as prevalent as electricity demand response, but it's still there. And if you are in those locations it would be good to kind of talk again to your utility provider and see if you can take part in it, reduce your load during those hours, because those disruptions also effect the customers as well.

Bruce Lung: Thanks a lot, Paulomi. The next question that has a lot of likes on it is do you know rebates or grants to help install smart demand controls for industry? I have to admit, I'm not aware of it, but I don't know if any of the panelists care to address that.

Jesse Tootell: Yeah, I'll briefly touch on it. It depends entirely on the utility you're talking to. We're fortunate to have a big footprint, and there are several utilities in the country. Southern Company tends to be one; PG in the Pacific Northwest is another one. California has had conversations about this as well for just a couple examples.

You can frame the net benefit of the controls and then kind of reframe the conversation as an energy efficiency project for a

custom rebate, and some of these companies have existing rebates that you can apply to controls.

Bruce Lung: Paulomi or Joe, do you care to weigh in on this one?

Paulomi Nandy: No. I think I agree with Jesse. The best information you can get or resources you can get is talk to your local utility provider because it's very customized to your local grid, local utility provider what they have. That would be the best place to start.

Jesse Tootell: And sorry, Bruce, one more thing here. A lot of times the vendors have this network, right? If you're talking to a vendor about those controls installations, they're the ones that have the relationship with utility or deeply understand that process, so you can leverage that as well.

Bruce Lung: Perfect.

Joe Benyon: And I'll just mimic both of them, yeah, just reach out to your local utility to see what sort of programs and rebates and grants are available for your industry.

Bruce Lung: Okay. Thanks a lot, Joe. There's one specifically addressed to Jesse. Was installing the automation software a hard sell to management, and do you use it at all your facilities?

Jesse Tootell: Yeah, so that's a good question. Short answer is change management is always difficult, and you have to make a pretty bulletproof case for a lot of this stuff, but that's where you get into just leveraging the data and just making it a pretty airtight argument for the results. We tend to approach this stuff as a proof-of-concept, meaning at one site we show it works, then a proof-of-enterprise where we show it works at a diverse set of sites, call it three to five sites, and then you can scale it.

So right now we're kind of in the process of scaling because we've shown that it works at that proof-of-enterprise level. Money talks, data shows it, right? And that's pretty much how we approach everything. We do have a gambit of some sites with the advanced automated controls, some sites with those kind of preset response controls, and then still many of our sites are manual but waiting in line for that upgrade.

Bruce Lung: Okay. Great. Thanks. And then Paulomi or Joe, if y'all want to add anything to this, it pertains to you as well.

Paulomi Nandy: I think I would just add quickly, as Joe mentioned, he used maybe one or two sites as like those pilot sites and see what the benefit is. That way you can get some of those champions out and you can learn from them. I think that is a good place to start. Again, depending on where you are, what kind of demand charges are there in your facility, like doing basically a utility analysis, how much you're paying would be a good place to start. Those might be a good candidate to do some pilots and see, and then it just becomes a better case study to sell for your upper management.

Bruce Lung: Okay. Great. One of the next questions that had a lot of likes was how do I know if I can benefit from a demand response program? Is there a resource to check to see if I'm eligible? I would imagine this depends on where you are in the country and what your utility offers, but I'll let the panelists weigh in.

Jesse Tootell: I looked like I was talking but I was on mute. Sorry about that. Leveraging, again, vendors in a lot of the deregulated markets, ERCOT, PGM, they're going to want to be your market participant or your broker for this process. They can do the announcements for you. Other than that, just communicating with your utility provider or your utility rep is the best way to just go about figuring all this stuff out and doing that sort of analysis.

Bruce Lung: Okay, great. Does anyone have any advice on persuading the higherups about the significance of submetering for data collection and visualization? Some folks seem to be hesitant because of the upfront costs, and this is a perennial problem that we've seen for a lot of submetering and other instrumentation-type devices. So whatever wants to take it on go ahead.

Jesse Tootell: Yeah, I'll take a stab just because we've been on that walk for many years now. We're on the other side of now where our company just universally accepts the power of data-driven decision-making. But no one ever starts there, right? I think the most powerful thing you can do is latch it to future initiatives. Why do you want this submetering?

Looking at it for the sake of looking at it can be useful and great for accounting and just kind of general management practices, but do you have initiatives that will leverage those data in the future that can save money? Can you just use the submetering to save money by itself? I showed a picture of kind of the manual response warehouses we have where if the site is aware of its energy usage that's step one to being able to respond to programs, if you can

latch it to a demand response program revenue, for example. I think just adding and outlining the value of that data is important.

Bruce Lung: Paulomi or Joe, do you have anything?

Paulomi Nandy: I will just add a little bit to that. Basically submetering not just helps the demand response but it helps with multiple different things. As we are talking about just understanding where you're using your energy, when you're using that energy, just how to kind of drive energy efficiency, drive carbon initiative energy like if you're doing switching or whatnot. Everywhere right now there is a push for submetering or there should be a push for submetering just because you have better data to inform and have accurate information to present to your higher management. So it's not just for demand response. It's for everything. You need that accurate data.

Jesse Tootell: It's a measure to manage problem, right? If your leadership is unhappy about the cost of energy, and they're not investing in submetering, then they can't really complain about the cost of energy because you have no tools to help reduce that cost.

Bruce Lung: Then another question that seems to have gotten a lot of likes so far here is what options do you have for manufacturers that are operating 24/7?

Jesse Tootell: I'll go again here. Sorry to hope on all these first. There are many processes like this, and it really comes down to optimization, in my view. So if you have all the inputs you need to understand, hey, this is the cost – this is what we're losing out on when we reduce our load for a demand response event, and you know the value of the demand response revenue stream for you or the savings stream, then just make that a computer problem to solve, honestly.

What's the current cost of shutting down and is it worth it? And then you just iterate through that and that's pretty much all you can do, and then obviously focus on other initiatives to just drop your load in general, energy efficiency projects, things like that. Yeah, it just has to be a real-time, data-driven decision.

Joe Benyon: And just to kind of add to that and to expand upon your energy efficiency, you have all these programs and rebates available right now to be able to make your facilities as efficient as possible such as switching to LED lighting, occupancy sensors like Paulomi mentioned in her presentation, trying to do that just to reduce the

overall load as well which will help your overall operating costs and power costs.

Paulomi Nandy: Yeah. There might be some areas in your facility that are not always there, like you might have offices in some areas or you might have warehouses, like those are not always being operational. There are not always people. If there are certain areas that you can at least do some kind of occupancy sensors or BMS system that kind of controls and turns off and turns on and setbacks and stuff, that's also something. So it's just depending on how you're using the different areas in your facility.

Bruce Lung: And just to –

Jesse Tootell: Sorry, Bruce. One more thing. I also think that onsite generation in batteries, invest in capital assets that can help you manage load, specifically with the managed response but just in general if you just have a steady state load that you always need to keep on.

Bruce Lung: Well that's what I was going to ask real quick, Jesse. Do you think this is where storage could help reduce demand loads for companies that run 24/7, for example?

Jesse Tootell: Yeah, absolutely. If you go talk to a battery vendor, that's going to be the first thing they talk about is demand charge management and that load shed away from those peak times. We've invested heavily in onsite generation. We're on track to be I think the third largest commercial industrial developer of solar by the end of this year. We have batteries, we have generators. That's a big part of our portfolio so we see the value in that and encourage others to look at it as well.

Bruce Lung: Okay. Perfect. There's one question here that has been hanging around for a while asking if a similar document were made in the future focused on residential and commercial spaces. The short answer is I'm not sure. I personally think this would offer a lot of value for commercial and nonindustrial end users, so I think we'll use this as a suggestion to take under advisement and see what we can put together.

I'll go ahead and take one last question because I know we're running close to the hour. This question here is, is there a point in solarized buildings – I guess those are buildings that use photovoltaic solar panels to get electricity – where the electricity demand becomes less of a concern for the actual residents and other building users?

Jesse Tootell: I'll touch on this. At least in California, a lot of sites with a lot of solar are starting to see this power curve, the duck, the belly of the duck, the neck of the duck, where solar can help reduce energy costs when the sun is up, but you're seeing the peak times occur in the evenings when the sun is dropping down. So in general, there's still a need for some demand management when the sun is dropping that I think should be addressed for solar buildings.

Bruce Lung: Paulomi or Joe? Anyone? Feel free to jump in. Okay, terrific. Well I think this concludes the question and answer session for today. We've got to keep on schedule.

So I'll just go over a few closing remarks here. This webinar has been part of the 2022 Better Buildings webinar series, and as you can see we have a great lineup of webinars all the way through the middle of August. We encourage you to sign up for these and attend these webinars. The next one will be on June 28th, and it'll be titled *Clean the Air; Healthy Indoor Air for Businesses and Tenant Spaces*. So we encourage you to join this webinar to learn ways that small business owners particularly and building managers can ensure healthy indoor air quality for staff and customers.

Our next slide deals with the progress report. So each year, DOE releases an annual report with key findings, updates and metrics from the Better Buildings Initiative, and that includes Better Buildings and Better Plants Challenge Partners. So please visit the Solution Center to explore the 2022 report and learn how DOE and other partners are working for a more energy efficient future. And with that, I think it comes to our last slide. I'd like to thank our panelists very much for taking time with us today.

I'd also like to thank the attendees for staying as long and for asking so many good questions. Feel free to contact these presenters directly if you have additional questions or if we couldn't get to your question during the Q&A period. I encourage all of you to follow the Better Buildings Initiative on LinkedIn and Twitter for all the latest news and social media content. You can find our handles by their respective icons on the left half of the slide.

You will receive an email notice when today's recording slides and transcript are available on the Solution Center. So thank you, everyone, and have a great day.

Paulomi Nandy: Thank you.

Joe Benyon: Thank you.

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