Hichem Hadjeres: Hello, everyone, and welcome to the 2020 Better Buildings Better Plant Summit, a virtual leadership symposium. Thank you all for being with us today, we have a wonderful session prepared and some fantastic speakers we are going to introduce in just a moment. Before we dive in, there are a few housekeeping points I would like to go over. Please note that today's session will be recorded and archived in the Better Buildings Solution Center. We will follow up when today's recordings and slides are made available.

Next, attendees are in listen-only mode, meaning your microphones are muted. If you experience any audio or visual issues anytime throughout today's session, please send a message in our chat window located at the bottom of your Zoom pad. My name is Hichem Hadjeres, and I am a fellow with the Department of Energy, where I help lead our energy recovery technical assistance to wastewater facilities as part of the Department of Energy's Sustainable Wastewater Infrastructure of the Future Accelerator.

Next slide, please. We are excited to announce that today we will be using an interactive platform called Slido for Q&A and polling. Please go to www.slido.com using your mobile device or by opening a new window in your Internet browser. Today's event code is #BBSUMMIT. Once you enter this event code, please select today's session title in the drop-down menu, The Road to Resilience.

If you would like to ask our panelists any questions, please submit them anytime throughout the presentation. we will be answering your questions near the end of the section as well as taking clarifying questions after each speaker. You also have the option to vote or like a question that your fellow attendees put forward. I'll give everyone a few moments to open up Slido and select our session, and then we will continue with our presentation.

Better Buildings is an initiative of the U.S. Department of Energy. It's designed to improve the lives of the American people by driving leadership and energy innovation. Through Better Buildings, the DOE partners with leaders in the public and private sectors to make the nation's homes, commercial buildings, and industrial plants more energy-efficient by accelerating investment into sharing of best practices.

Each year the Better Buildings Summit continues to host innovative session topics and features speakers who are leading the way in energy efficiency. Thank you all for participating this year in helping continue our annual summit on the virtual platform. Next slide, please. For the agenda today, I will start us off with an introduction to our session, then we will have presentations on the Department of Energy's Sustainable Wastewater Infrastructure of the Future Accelerator, which will be followed by a bit of driven tool-making at the Metro Wastewater Reclamation District in Denver, Colorado.

And lastly, we will have a section on innovative technologies to promote energy conservation at the Water Resources Recovery Department in Saco, Maine. Next slide, please. So, why energy management and wastewater? What's the big picture? Water and wastewater treatment facilities can account for up to 30 percent of a municipal government's energy use. Within a facility itself, the electricity bill takes up between 25 to 40 percent of a facility's annual operating budget. And unfortunately, this trend is not unlikely to go away anytime soon.

Energy use is expected to grow by 20 percent due to more stringent regulations. With the threat of emerging contaminants such as PFOS and other endocrine disruptors, many facilities have to upgrade their facilities with more advanced and energy-intensive treatment processes. There's also a trend towards water recycle and reuse in some parts of our nation due to stresses on water resources, which is also an energy-intensive process. There's also the added challenge of increased demand from population growth as well as aging infrastructure.

In short, there's quite a lot of money going to the electricity bill that could have been saved or used to help aging infrastructure. However, there is a silver lining to all of this. Retrofits can yield up to 50 percent in energy savings with an average of 30 percent. These can include everything from building improvements that include changing your bulbs to LED lamps to reducing energy to band through process optimization measures such as installing VFDs for pumps to ensure power usage is in response to actual load. There are also energy recovery generation technologies.

The energy embedded in wastewater can cover between eight to ten times a facility's actual energy use and this includes enhanced bio and gas recovery. So, we not only can move towards net zero but energy positive wastewater plants that can also act as

distributed energy resources as well. Next slide, please. Now, the question is how do we get onto the road to resilience and how do we stay there? Really, this boils down to a few key factors. First of all, setting energy savings as a priority and with the situational awareness of your facility's energy use and the implementation of data-driven best practices.

Over the years, many examples have been documented that demonstrate significant energy reductions are possible through cost-effective measures. Building on this success, many in the industry are taking a broader, more strategic approach to energy management. To implement the vision, however, wastewater treatment plants are setting ambitious, long-term energy savings targets and incorporating renewable energy as well. We are in the era of big data, we have a lot of data-points for everything, but the question is what do we do with that data once we have it?

As the wastewater treatment sectors approach, energy management evolves the need for reliable and robust energy data management systems is growing as well. These systems help plants track progress towards their energy goals, and they help to determine whether their efficiency efforts are having a meaningful impact. It will help them uncover opportunities for savings. It will also allow for comparison to other similar plants. In short, to stay on the road to resilience and have a robust energy management system, our facilities need robust energy data management.

Next slide, please. So, I'll transition to our speakers who will go over these topics. I'd like to introduce Shannon Zaret, who is my colleague at the Department of Energy. She is an energy technical product specialist. Shannon Zaret recently joined our office and she is our office's wastewater and circular economy lead. Prior to joining the Department of Energy, Shannon served as a Project Manager for Booz Allen Hamilton supporting the DOE's ARPA-E research and development programs, which focused on energy storage, waste energy, and nuclear fusion.

She was also at the United States Energy Association, where she worked on the Department-of-Energy-funded consensus program to build global and domestic consensus on carbon capture utilization and storage. Prior to joining the U.S. Energy Association, Shannon supported the U.S. Department of Energy's Bioenergies Technology Office, nicknamed BETO, while there she helped the Office's priorities aimed at developing technologies for producing cost-competitive advanced biofuels from non-food

biomass resources. Shannon, the floor is yours. Thank you very much.

Shannon Zaret: Thank you, Hichem. I'm excited to be here. I'd like to take some time to discuss how DOE has been involved in this space from a Better Buildings perspective. So, let's start with the next slide. Perfect. So, specifically, I'd like to highlight one of our Better Buildings accelerators that was designed to catalyze the adoption of innovative and best practice approaches in data management, technologies, and financing for infrastructure improvements and water resources recovery facilities.

So, the Sustainable Wastewater Infrastructure of the Future Accelerator, or SWIFt, as we refer to it, was a three-year partnership with 25 state, regional, and local agencies that engage with over 50 water resource recovery facilities in their jurisdictions. And the overall goal was to accelerate a pathway towards sustainable infrastructure. So, individually the SWIFt partners sought to improve the energy efficiency of their facilities by at least 30 percent and ultimately integrate at least 1 resource recovery measure.

And during the program, we have four activity phases. Participants focused on four key building blocks of energy management, so energy data management, measure planning, project financing, and plan development. And the resources developed through this effort ultimately resulted in the creation of the wastewater energy management toolkit. And we're actually planning on releasing this toolkit this summer so that facilities can learn and benefit from the work of SWIFt 1.0.

So, next slide. So, here I just wanted to provide a visual to demonstrate the scope of the SWIFt 1.0 partnership. It was fairly broad with 25 state, regional, and local signatory partners, which represented over 70 wastewater facilities, and cumulatively, our partners treat about 4 billion gallons of wastewater daily and serve over 25 million people. Next slide. So, with that perspective, I would like to jump into reviewing the resources that you will be able to find in the toolkit.

And again, these resources are grouped so that users can easily find the information they need at each stage of their decision-making process. So, the first step towards improving planning is understanding and managing a facility's energy data. And so what you see here is the energy data management manual and it explains

how to develop strong energy management programs and provides step-by-step guidance on how to appropriately track energy performance. It contains a one-page comparison tool of publicly available energy data management tools, so you'll see the portfolio manager, energy performance indicator tool, and the energy assessment tool. So, they essentially provide a good baseline for tracking a facility's energy use that will eventually aid in decision-making down the line.

Next slide. So, the next component of the toolkit focuses on different measures facilities can put in place to achieve energy-cost savings. So, SWIFt Accelerator partners identified 23 common high-impact and innovative energy conservation and resource recovery measures targeted at equipment, management approaches, and daily operations. And so these are reflected in our no- and low-cost checklist that you see in front of you.

And to give you some additional context, these measures were recommended by Doe Industrial Assessment Centers and when implemented at various facilities, we're seeing on average a consistent showing of 5 to 7 percent energy savings, with an average of less than two-year payback periods.

Next slide. So, to help facilities decide whether and how to implement one of these 23 energy conservation measures, SWIFt Accelerator partners in consultation with sector experts developed an automated measure-planning workbook. This automated tool includes decision criteria a facility would need to consider when investing in a specific measure. So, those include evaluation factors such as implementation and operational needs, payback, and results.

So, users can decide how important each of these considerations are for their overall decision-making and assign a corresponding weight. So, depending on an individual facility's priorities, this tool's really nice. You can score individual technologies, you can score vendor proposals, and see them side by side as a kind of cost-benefit analysis. And the SWIFt Accelerator partners actually used this tool while they were planning on how to get to their 30 percent energy savings goal.

Next slide. Okay, so once a facility has selected the improvement measures that they want, it may consider funding and financing options to take advantage of opportunities outside of just relying entirely on their capital budget. And so this is where our financing

matrix comes in. It includes resources for facilities to more easily evaluate financing and funding options. So, you can see it's a quick reference document on nationally available financing programs and key factors about what to consider when selecting one.

Next slide. Okay, and then we've also included a tailored guide for energy savings performance contracting specifically for water resource recovery facilities. So, it provides decision-makers with examples and resources to consider this as an option. Next slide. Lastly, SWIFt Accelerator partners committed to creating an infrastructure improvement plan outlining how exactly they achieve that 30 percent energy savings from whatever chosen baseline year.

And so these are nice templates that were used to help them figure out how to design that based on what their priorities and goals were. And so what's great is the finalized toolkit in addition to these templates will also have examples of infrastructure improvement plans from SWIFt 1.0 partners.

Next slide. Okay, so this is just a nice summary graphic to show that SWIFt 1.0 partners achieved on average 8 percent facility-wide savings using these tools. And so this is data from 2017 and 2018 and we're actually gathering 2019 data and we're hoping to release a summary fact sheet soon after the toolkit becomes available. Next slide. Again, I want to emphasize these resources that I just outlined will be released as the wastewater energy management toolkit in the summer of 2020 to help facilities learn and benefit from the work of SWIFt 1.0.

But we're also planning on building on the momentum of this effort by launching a second phase of SWIFt later in the year, and so the details I'm going to plan to discuss later at the conclusion of this presentation. But now I'm going to turn it back to Hichem, who's going to introduce Wendy Anderson, whose facility actually participated in SWIFt 1.0. So, Hichem?

Hichem Hadjeres: Thank you very much, Shannon, for a wonderful presentation. Next up we would like to have Wendy Anderson. Wendy Anderson is a senior engineer in the Strategy and Innovation Department at Metro Wastewater Reclamation District in Denver, Colorado. Wendy investigates energy technologies, tracks energy consumption, and manages the operations of a 6 megawatt combined heat and power facility fueled by biogas from anaerobic

digestion.

Wendy is a professional engineer and Class A wastewater operator in the State of Colorado and a certified energy manager. Wendy will provide us will valuable insights on setting energy savings as a strategic priority at the facility level and how that enabled the facility operators to develop data-driven tools that allow them to analyze their energy data and optimize their facility's energy management.

Before I turn it over to Wendy, please submit any clarifying questions to Slido. We'll have a brief five minutes after each speaker presentation to clarify anything. Again, slido.com, the event code, #BBSUMMIT, no caps, drop-down menu, The Road to Resilience. Wendy, the floor is yours.

Wendy Anderson: Thank you, Hichem. Can you hear me?

Hichem Hadjeres: Yes.

Wendy Anderson: Okay, great. Thank you for your introduction and good morning, everyone. I was asked to talk a little bit about how energy has become a priority at our wastewater treatment facility. The main reason metro wastewater is focused on energy conservation is mainly the cost. As a large wastewater treatment plant, we spend about $6 million a year in electricity alone and probably another $500,000 in natural gas.

We have sustainability goals that state we will decrease energy usage and subsequently greenhouse gas emissions but frankly, our $400,000 monthly electric bills grab a lot of attention from the managers and are a major driver for our energy conservation efforts.

Next slide, please. Here's my agenda, I'll briefly talk about who we are, our big energy usage and cost, our data system and how we use it to support energy management tools, and our future strategy to tackle big data. Next slide, please. Metro Wastewater Reclamation District is a wastewater treatment authority for much of metropolitan Denver. We serve about 2 million people. What you're looking at here is our facility and the mighty Platt River in the foreground, which we discharge to.

Our facility treats about 135 million gallons per day of wastewater. Our daily average electrical demand is about 14 megawatts on an

average and we generate, co-generate, about 5 to 6 million megawatts with that co-generation facility.

Next slide, please. So, how should we approach energy management? We can become energy efficient in two ways: we can invest in energy-efficient process technologies, which usually means a capital improvement project and all the large expenses associated with it.

We can also implement an energy efficiency program and try to optimize existing processes, which tend to be the inexpensive route but it comes with its challenges. For instance, operational changes take a lot of work to incorporate. Many times these changes force operators to operate the plant closer to the edge of process failure and those shrinking safety margins really make their job more stressful.

Also, once optimization efforts are implemented, it takes a lot of vigilant oversight to keep them in place and not to backslide into those older, easier entrenched bad habits. So, it's a little bit of a challenge. So, rather than adopt a conventional but somewhat rigid energy management protocol like ISO 50,001, our facility kind of goes after discreet efforts that we think have some chance of long-term success. Our goal is to make complex aspects of our operations easier to monitor and to manage using tools, and I'll show you a few.

Next slide, please. To keep tools simple and uncluttered takes a lot of discipline and I can't say our facility has mastered that. Our engineers seem tempted to fill a screen with a ton of information. We can be especially guilty of this. So, what you're looking at here are two basic tools that show information that may be of interest to operational managers. The first on the left plot is our energy consumption for the last nine years. This information is basic and comes right off the monthly bills and it's part of our energy benchmarking record basically.

The pie chart on the right shows our energy consumption by process area. We are so lucky at Metro Wastewater that we have a significant amount of power submetering around the plant. I think we have a power meter on most equipment greater than 25 horsepower and that allows us to make pie graphs like this and collect lots of process data. So, it's a good practice to just start installing these power meters on all large equipment whenever the opportunity presents itself.

Next slide, please. But it's really hard to keep the tool simple when our energy bills look like this with lots of detail. A spreadsheet tool we developed takes something like this complicated monthly electric bill and breaks it down into basic information that we need to understand our energy cost. So, from this bill we can see the bottom line, which happens to be at the very top in that circled section. I mixed up all these numbers but how do you determine a true unit cost of power and energy from a bill like this?

Next slide, please. So, after some experimenting we were able to develop the spreadsheet tool that simplifies information on our bill. What you're seeing here may not look like a simplification but it does allow us to transfer just a few of the cost from that original bill, enter them in this spreadsheet, and those are the highlighted cells you'll see on the spreadsheet there, so that the spreadsheet basically recalculates and reformats the bill, making it much easier to understand.

So, what we have are our energy costs and associated writers in the bill, and those are grouped at the top and you can see on the upper right-hand corner energy that is circled, those are the writers and energy cost. And we've done the same setup with peak demand charges and if you look a little lower down, there's a circle that says peak demand. So, we have our peak demand charges and all the writers that are associated with demand cost.

And what this allows us to do is calculate the true cost of our service on a monthly basis. So, what we have is if you look up at the energy area again of the spreadsheet, you'll see a total cost associated with energy. We take that total cost, divide it by our kilowatt hours used for that month, and that gives us our unit cost energy, which is a little less important for kilowatt hour.

And we do the same thing with demand, we take the total cost associated with all the demand charges and writers and divide it by our kilowatt hours, our peak kilowatt hours, and we get our unit cost for demand for that month. And we can combine those two unit costs into a bundled or all-inclusive cost, which gives us a general cost of energy of about $0.06 per kilowatt hour, which is a pretty good cost regionally.

Next slide. Here's another tool. Most facilities, most large facilities, have one-line electrical drawings showing the power distribution across their facility, and this is wastewater. Any kind of industry has these types of electrical drawings. And the

electrical system is somewhat hidden to most employees, and it can be a huge mystery to the average operator and to the non-electrical employees at your facility. So, what you're seeing here is a representation of our power distribution system on the plant site and it's derived from our one-line electrical drawing, and it's displayed on our SCADA system.

And it looks pretty busy at first glance, but with a few-minute study, it's actually pretty straightforward. So, what are we looking at here? If you look around at the screen, you'll see some yellow boxes and those yellow boxes, within them, show our 6 feeders. This is the location where electricity enters onto our plant site from the grid and the numerical read-out next to each unit there shows the amount of real-time power coming in. So, downstream of all these yellow boxes we have our load centers or the transformers, they call them PUs.

And these transformer units have also power that's listed next to them and that's coming in on a real-time basis. So, each one of these transformers is represented by a button. Believe it or not, those are all buttons there and that can be clicked and it allows the user to dive down and see what motor control centers and what individual equipment each one of those transformers provides energy to. You can also right-click on the numerical read-outs to get historical trends on how much energy has passed through that particular transformer.

And so why is this important to operators? Well, again, it gives them that giant overview of our electrical system, it's not a mystery anymore. And as an example of how we use it in our plant, we have power outages that are real emergencies and we experience them frequently. Our operators are our emergency responders and while some operators are running out on the plant site to get stuff restarted, others can quickly reference this screen and see specifically where the power failed through which feeder, and they can also dive down and see what equipment downstream is affected by that power outage.

Also, with all this submetering and data logging, the user can now more easily track what power is going into the individual process area and we use this detailed information for calculating our annual charges to our rate payers for making historical performance comparisons of the process units, and for populating our greenhouse gas calculator.

Next slide, please. So, what you're looking at here is a small snippet from our facilities greenhouse gas calculator and it shows some of the electrical usage data inputs, and that's in the upper left-hand corner there, that I can get from our submetering, from that screen I just showed you, and data logging efforts. So, what you're seeing is our individual process areas and the electrical energy associated with those process areas.

And when we enter in that power usage, the calculator calculates our greenhouse gas emissions associated with that process unit. And this allows us to see what processes have the highest greenhouse gas emissions and take corrective actions if possible.

Next slide, please. Another tool we have developed provides screens giving real-time status of our power and energy consumption. These screens are not on our SCADA system, they use a different software package that allows us to pull data from our data-logging system and display it. This particular page again has a lot of information on it so I won't go over everything but there's a few items on the screen that have proven very helpful to our operators.

First, we have a display showing our total energy use per day in the upper left-hand corner, and you'll see a lot of spikes. Each one of those spikes represent one day of energy consumption and it basically follows the pattern of our influence load or our plant. And below that in that same plot, you'll see a straight line. That's our co-generation output and then the power we'll bring in from the utility. And the very top line shows our total energy usage on the plant site at any time. Below that we have two different demand plots that cover different times of day, and I'll describe them to you.

The middle plot, the distribution plot, is applicable to most times a day and is the least expensive demand per kilowatt. A second type of demand is between 2:00 PM and 6:00 PM on weekdays and it's more than three time as expensive as the demand shown in the middle plot. And so we want to avoid setting any peak demand, of course, during that 2:00 PM and 6:00 PM time period. And every time we set a new peak with either type, that top straight line on both of those plots increments upward, and to the right, the magnitude of that demand peak is recorded so operators know at any one time what is our demand peak.

So, we try to minimize demand during that 2:00 PM and 6:00 PM

time period by not starting any large equipment, but that's not always possible. So, let's say it's a weekday afternoon and the operations group needs to start a large piece of equipment, it's the worst time of day. If you look over on the right-hand lower side you'll see a box, and in that box you'll see a category called Gap Demand to Peak.

Under that title we have our five largest pieces of equipment listed, and what this tool does is informs the operators whether it's okay to start this equipment without triggering a new demand peak. So, looking at that area, we can see that it's green or okay to start a northwest blower but it's not a good idea to start a northeast or south blower because it's red and most likely will establish a new demand peak if it's started, and it will generate more expense for our facility.

Next slide, please. We also have reference tools like this one that shows our four largest process areas and their energy consumption, how much energy they're consuming real time, and the percentage of plant load. And if we look at the two left-hand boxes, we will see them labeled the north and the south process area. Both of these areas do the same nitrification process. The north is obviously consuming more power, greater than 4000 kilowatts, than the south plant, which is consuming a little over 3000 kilowatts.

But the next metric listed below shows that the north plant is using only 49 kilowatt hours per million gallons treated, whereas the south plant at this current time is using 69 kilowatts per million gallons treated. So, what that tells the operators is if we had more capacity available in the north, it's probably cost-effective and energy-effective to shift some flow to our north plant. And that helps us be more efficient.

Next slide, please. So, moving forward, that's a few of our tools. Using that same software we're also developing monitoring and optimization tools for most of our process areas because we believe optimizing any process usually results in less energy use. We've also begun to use artificial intelligence to optimize one of our process units, our wastewater disinfection system, which if we are able to implement that, it'll allow us to use less chemical addition, at least that's our hope.

So, in summary, we believe it's hard to measure how tools like the one I just showed you really help us conserve energy, but what the

screens I think really do is, at the very least, bring the data out in front of the operators, it increases their awareness of our current energy consumption, and this visibility of energy information assists the operators with becoming familiar and comfortable with energy concepts as we slowly add more ambitious energy conservation efforts. We also believe that we should focus on keeping tools simple.

Operators are busy people, we need select designs that make it easy for operators to make the right decision quickly without a lot of study. We need to subtly remind our operators and other employees that we're trying to save energy and that we have sustainability goals. These aren't wasted words because the employees are truly conscientious, but they are under a lot of pressure. They're frequently multitasking and making judgment calls that may sacrifice our energy efficiency but in the name of permit compliance.

And for the long term, our facility is also formulating a big data strategy, which we hope will make us more productive at harvesting data. All the operational tools I presented here were developed from software platforms I think most of us are familiar with. Mostly Microsoft Excel in conjunction with other software packages that extract our archive process data and allow us to make handy dashboards. This group of softwares are fine but as analytical tools, they're not a very efficient way to truly extract that data we're collecting virtually every second.

So, going forward, our immediate strategy for bridging this functionality gap is to invest in user-friendly hopefully artificial intelligence software, some sort of platform, that's capable of merging and analyzing a host of different process data sets that we collect on site. And based on this new platform's capability, whatever it is, we aim to establish a best management practices program just for data management.

And last but not least, we have hired some folks with the science and programming know-how who really know how to help accomplish this huge task. So, that's what we're doing with energy management and our strategy for tackling the big data challenge.

Next slide, please. And with that, I want to thank you for this opportunity to speak about data-driven energy management tools and data-driven decision-making. Thank you very much.

Hichem Hadjeres: Wendy, thank you very much for a spectacular presentation. By the way, everyone, Wendy was actually a SWIFt partner so she has been an asset obviously to her community but to the DOE as well, and she is certainly leading by example. I'll have to speak to what she said about the whole artificial intelligence thing. There were a lot of questions Wendy was actually asking about the different software platforms that you used, and you speaking to the fact that at some point you have to streamline everything really points towards the direction we need to be heading. So, again, thank you very much for leading by example.

We do have a lot of clarifying questions I'd like to underscore a lot so I'll try to get as much as we can. To the attendees, we are going to have a general Q&A for some of the questions that you have for Wendy so I'm going to pick the ones that are about some of the things that Wendy said that are pertaining to something specific that needs to be clarified. So, Wendy, one question that was asked, quite a lot of them again, when you run these numbers are they as co-op hours per gallon per day? So, if you can answer that real quick just so...

Wendy Anderson: If it's just raw energy it's kilowatt hours but we do look at a lot of metrics on our facility that are kilowatt hours per a million gallons treated, yeah. I hope I answered the question. And I would say so, I would designate the units there kilowatt hours per million gallons.

Hichem Hadjeres: All right, yeah, because we do it with MGDs in our industry. Awesome and –

Wendy Anderson: It's –

[Crosstalk]

Hichem Hadjeres: Go ahead, please.

Wendy Anderson: I'm sorry.

Hichem Hadjeres: No, please.

Wendy Anderson: It insinuated a million gallons per day. I guess that is a million gallons per day, sorry.

Hichem Hadjeres: Don't worry, awesome. And there was another question I think about the meters that you use. So, we have a question, please tell

us more about the power meters' large end uses, wireless, simple Cts?

Wendy Anderson: Boy, that's outside of my line of expertise. I really depend on our electrical folks to spec out the best meter. Frankly, a lot of equipment comes with this type of energy monitoring and a lot of facilities just fail to tie it into their system. If you walk out, you probably do have a lot more capabilities than you realize, it's just a matter of telling your electricians to tie that output into your SCADA system, your data collection system, and take advantage of that instrument.

Unfortunately, I don't have a specific meter to recommend. I could have told you about three years ago but right now it escapes me. But there's a host of excellent equipment out there that can be purchased for your purposes.

Hichem Hadjeres: Awesome, and it seems like we're getting a lot of questions about the slides and whether they're going to be available. The answer is yes and we certainly look forward to sharing that. The RBT tech team will take some time to put them together but they will be made available. We also have some resources for you at the end of the presentation that we'll let you know where to follow us on social media and also links to get any updates on the toolkit and the slides and the Summit in general. We'll take one more.

It seems like I'm getting a lot of questions about the platform that you're using, and I know you mentioned that briefly, but it seems like there's a question if something like this is commercially available or if you guys built it yourselves or was it custom built for you, and how difficult it was to set up. And I understand that eventually at some point everything will have to be streamlined through artificial intelligence but if you could speak to that, Wendy, that would be great.

Wendy Anderson: For sure. Our SCADA system was developed by a company called ABB and it's called Industrial IT and it's pretty common out there. Our data extraction system was developed by a company called Osi Soft, that's Osi Soft pie system, and it's a historian. It basically takes all your process data and stores it and then we have an extension of that company. They make a product called pie vision, that allows us to develop those pages, and I must warn you that we do hire engineers to generate those pages.

So, that's the level of expertise it requires to generate those pages.

I'm not saying a sharp operator couldn't do it but you've got to let them sit down and really study the software and what it's capable of to take full advantage of it. And for AI software, we're looking at a package called Ultrix, and frankly that's all I can tell you about it other than our engineers are very excited about it. It's just a matter of convincing our management that it's worthwhile. We're also required through our procurement rules to look at other AI packages besides that one, but that's one that seems to stand out for us.

Hichem Hadjeres: Wonderful, and Wendy, just so you know, you are going to have some more questions towards the very end so I just wanted to have some of these clarifying ones out there. Again, thank you so much for a wonderful presentation and it segues perfectly into our next speaker, Howard Carter. Next slide, please. So, it's my pleasure to introduce Howard Carter. Howard Carter is the Director of the Water Resource Recovery Department of the City of Saco, Maine, a beautiful town I highly recommend visiting.

Additionally, he is a 2019 and 2020 Member of the Board of Trustees for the Water Environment Federation. He is also an active member of the New England Water Environment Association and I actually have had the pleasure of working with Howard and NEWEA, and he led the efforts to create a water innovation council. Again, that was a really fun project and I was with him up until I left for DOE. So, it's truly a pleasure, Howard, having you with us.

Also, Howard – long resume but we'll try to do it justice – he was also a past president of the Maine Water Environment Association in 2002, and he was also the president of NEWEA back in 2010. He's a graduate of both the U.S. Naval nuclear piping mechanical four-year apprenticeship program in the Southern Maine Technical College wastewater treatment and environmental program. So, Howard, will offer us a very interesting perspective. So, we heard previously on what it's like to manage your facility, what it's like to have your priorities at the facility level.

So, Howard will do the same but in addition to telling us about the different energy saving upgrades at his facility, he will also offer some insights about the role of local government planning and policy, and what that had in setting energy management goals for his facility specifically. And how these retrofits reflect the CD of Saco's broader energy policy. We'll see how that type of integrated planning led to this facility to deploy upgrades.

And actually, some of these upgrades, remarkably enough, you would find them at larger facilities, not at the smaller facility in Maine. So, it's, again, really interesting to see how that type of integrated planning will let relatively small facilities play in the big leagues. So, Howard, the floor is all yours.

Howard Carter: Thank you, Hichem. Like you said, welcome everybody, beautiful weather up here in sunny Saco, Maine. Next slide, Cameron. So, basically, for you folks that don't know, Saco is located about 85 miles north of Boston. We have some beautiful beaches in town, we've got the Saco River that goes down through it, and we have a historic downtown with a great shopping district. So, we get a lot of tourists, although this year, a little tough. Maine is a very big tourist state and that's just not happening this year. Hopefully, it'll change here pretty quick.

Next slide. So, this is just an aerial of our facility. We kind of have a cracker jack public outreach department that does a lot of drone fly-overs and stuff. So, they've done a lot of good videos for us. This is just a picture of our staff, we're a very small facility. We have myself, I've got a Deputy Director, an industrial pre-treatment coordinator, our lead operators, two operators, two mechanics, and a master electrician. He also does all of our skater work and industrial-technology-type stuff.

Next slide again, and the next one. So, basically, just to recap before I get started, we have just over 4700 residential connections, about 378 non-residential, and that'll be schools and government. Our average shore aid in town is just over $87 a quarter. We've issued a big part of our budget, $186,000, back in rebates for sub-leaders and those types of things.

Last year, just over 46 inches of rain. I think as Wendy alluded to rain can certainly impact your electricity decision and your fall, especially because we're a combined community. We average just over 2 million gallons a day, I think that's how many residents Wendy had in her slide. A little over 2500 pounds a day of VOD and just over 2000 tons of biocells producedNext slide

Next slide. So, this has already been talked about a little bit with Shannon but it's still true, 3 to 4 percent of the energy usage in the United States is in water and wastewater facilities. I tend to think it's getting a little bit better and even in town here in municipal government our wastewater plant does take up about 30 to 40 percent of the total municipal budget. We did start an energy

committee back in 2006 with myself, a council person, and one of my operators and we tried to take all those types of things on back then, and I'll go through some of the things we went through. Next slide, Cameron. So, some of the things that we have done over the years to help with our electricity is we put in a lot of mini split heat pumps. I think a lot of you folks probably know what those are now, especially they're pretty prevalent in the northeast.

It's where you would have a condenser outside the unit inside so you can use it for both heating and air conditioning. We have some of those in our lab in the administration office and we have a lot of them in the pump stations. What's good, especially if you have above-ground pump stations, it helps with all the condensation in building this. It's the little things like that that no one would even think about, you don't have to really run dehumidifiers. We got some solar thermal heat I'll go over, energy-efficient equipment I'll go over, heat recovery ventilators, which hopefully most people have by now, some solar air heaters, and some daylighting.

All right, Cameron. So there's a picture of a mini split heat pump, that's actually one of our newer pump stations. Like I said, you get a small building that's like 16 by 20, those do a great job, and there's a little wind turbine that we put up outside of our admin office. That's a story in itself. Back when we started the energy committee, we had this one councillor, I want to have wind power, I want to have wind power, I want to put up a wind jet. So, we had this company come in, okay, yeah.

So, I call down to UMass out of Lole. There was a professor down there and she was big into wind power studies and she says the first thing you want to do is do a analogical study. I go okay, so how much is that? She goes around $140,000. Okay, so I tell my councillor, oh, no, we're going to do that, we'll just put one out. Really? So, we tried putting this little one up here by the treatment plant by the admin building, which is right on the path. There's a big walking path right along here because we've got the railroad. And word to the wise, just because you think it's windy doesn't necessarily mean it's windy.

It didn't really pan out but it looks good and people still get some comment on it. But always be wary of wind power and always do a study first, because this one went to a bigger one that was installed downtown.

Next slide, please. Solar thermal heated head works, this is an upgrade that we did in 2006. As you can see on the top of that building is some evacuated panels on there. For those of you who don't know to the heat, solar, that makes solar hot water, and what that unit does, to the right of that picture you'll see these two electric water heaters in there. Actually, when there's a ten degrees delta it'll actually kick water from the panels down to those tanks and pre-heat that water.

So, what happens in the winter time with this building, this head works building that's a Class 1 Div 1, it just has radiant heat in the floor. And it's an unstaffed facility so we just try to keep it around 50 degree and that works for us all winter. Very seldom, unless it's way below zero, do the electrical elements ever kick on in those units. That's been great for us, that's been a real good run. That's a keeper.

Next slide, please. Other things we've done is if you look to the picture to the left, those are solar air heaters that are actually fairly passive. The sun comes around, these are on the south side of our process building, and as the sun heats up that metal plate, there's little snaps which control her on there that kicks on a little mushroom fan, and that just blows warm air into the building and dusts it off the floor into in the building. Those work very well, we have them in quite a few pump stations as well.

This other little building to the right is a little dumping station for Poland Springs water. I'm sure most of you have heard of all the different drinking water, Poland Spring bottled water. But we have a facility probably 30 miles from here in the Saco River watershed that they dump a lot of their broken bottled water and rinse water in the tanks. We've treated the treatment plant but there's just a spot off site that they dump that, and that's all powered by solar. You've got metering.

Next slide. So, the lighting, I don't know how many of you folks have done these but we really like these. These are actually solar tubes that we actually penetrate through the roof and go into a building. This particular one is in the laboratory so if it's daylight then you don't really need to turn the lights on. Most of our pump stations that are on submersibles also have these in there, very good, and by now I would think everybody's pretty much switched to LED lights. I would hope so.

In fact, I remember back in 2006, during the presidential election

our energy committee that I was chair of and I'm still chair of, we were actually passing out these CFL bulbs way back then, trying to get people to switch. But now those are all gone and we've gone to LEDs. But anyway, all of our city buildings with the exception of a little bit of city hall have converted to all LED lighting and we're also in the process of converting all of our street lights as well.

Next slide. Variable frequency drives. Now, I'm sure most of you all have these by now. Most anything that we do, I don't think I have a single motor in the plant, I'd have to ask Stacy, that's even a single-phase motor anymore. Everything's all three-phase, whether it's for a converted three-phase for a conversion, or if it's for process control, because most of the energy upgrades that we do is more process-driven than it is energy-driven. We try to get two for. We want either diffusers or membrane diffusers for aeration being, we certainly need the VFDs and we've had a lot of good energy savings with the VFDs. In this particular case you got line reactors in front of all of them.

Next one, please. Geothermal heat pump, now here's quite a story with this one. We built a new process building in 2010 and we wanted to be one of the first ones. It wasn't leading-edge but it was kind of cutting-edge. We said, we'll take our influent and we'll try to heat the new process building. And we did a lot of research and we ended up going with a company in Maine called Nile. The numbers were good, the CPI performance was like 3.5. We took off, it worked very well but after about – just to come back to this, this is an open-loop system. There's open loops and there's closed loops.

This one was an open loop that we would draw out of the chlorine contact tank, it would go through a heat exchanger above these units, and dump back downstream in the contact. Now, those worked well for a while but also in this building is our dewatering. This is in a separate room. What happened, eventually, is this little capillary tubes on these units that hold your freon and your oil and after a while, the hydrogen sulfide, even though it was very low started to aerate and disordering these things. There was no silver involved so we were continuously chasing leaks.

It got so bad after a while that in 2018 I think we actually had to remove the unit because it wasn't keeping up with the heat that we needed. We had a real cold winter and then we had it converted into propane, which I'll speak to a little bit going forward. And

then in a few slides I'll show you just how efficient these things actually were when they were running.

Next slide. Heat recovery ventilating unit, I think a lot of people have these now per NFPA 20 where you need your air changes. This is in the room where we have our dewatering equipment so it's always as new makeup air's coming in it's taking the air that's in the building and pre-heating it before it goes. Those are pretty common, like I was saying. Next slide.

Fournier press, everybody, I think most everybody except for the real small facilities, have gotten away from bell presses and maybe they've gone to something like a rotary press or the other one, it isn't coming. The Fournier's a good one, we can run that 24 hours a day. No rotary comes off that, it's a very good process. And our cake went from 22 percent to averaging up around 28 percent so that alone saved us $50,000, $60,000 a year just in bio-solid disposal.

Next slide. I'll get into this one a little bit. Here has been our electrical usage for the last four years. As you can see, back in 2017 we were just under a million kilowatts. The following year, we were at 979. So what happens there? That's probably more weather-driven than anything else as we are still a combined community. But if you see in 2019, that actually drops to 942. So, what that represents is a drop of 36,000 kilowatts. Now, that's contributing pretty much to the fact that the geothermal system was not right. That's when we switched over to propane.

So, if you calculate that out at what we're currently paying at about $0.06 per kilowatt hour, that was taking us just over $200,000 to heat that process building. Now, conversely, that next winter in 2019 when we converted to propane, we actually burned through 4700 gallons of propane at a cost of $9000. So, that to me just tells you how good that technology is. You just have to have the right one and I think if I had to do it again I would go with the closed-loop system and not an open-loop.

Next slide. Okay, here are some things to consider going forward, especially for the small utilities. I know Wendy and her staff does a good job of tracking that data, but with a crew of 10 and 32 pump stations and all the other different things going and fossil fuels and stuff, some folks may want to look to utility-bill-pay and data collection. I'm not talking about the bills that you send out, this is more about having a third party, such as NG, somebody that

actually pays your bills.

We just did a contract with NG and it's going to be $3.99 per bill, but with that they track all your usage, you get the graphs, you can see if there's a spike, if something's off they notify you. We had an instance last winter at a train station that the propane spiked up like triple usage in one month and we have so many bills in the city that as they're going up to accounts receivable, it wasn't picked up and they were just signing off on that. Where if we had something like that we would have picked up on it and we got it real good and resolved that in a hurry.

So, that's something for a small utility to think about. And another thing, especially if you're a net metering state like Maine is, it used to be that if you generated your own power you could go to ten different buildings with that same power. Now that's unlimited, so in our case, say we're in Central Maine power district, we could actually go through a third party and purchase all of our power through renewables.

Say if we wanted to buy into a solar farm, we could buy 100 percent of your power that way. I wouldn't recommend it, I'd probably stay towards 75 just because of changes in the way you operate. But you could get a guaranteed contract for 20 years at, say, $0.07 cents a kilowatt hour, and that's guaranteed, and all your energy is coming from solar that has no upfront capital cost to you. So, that's something that's worth considering and looking into, especially if you're in that metering state.

And then finally, there's some new technologies coming out that everybody's sharing about hydrogen and other things going. We're actually working with a company, our main manufacturing partners, that's doing some studies here in some neighboring communities about converting wastewater into hydrogen. There's been some good luck with that, doing it on a pulse electrolysis-type thing. It's not really electrolysis, it's solid electricity current, it's more of a pulsed.

And the side benefit of that is it also produces chlorine or hydrochloride when it's doing that so you can also get a disinfection on the side. If anybody's interested in that and they're coming up with a new website, it's mmph2.com. Motorcom is still in its infancy but I see big things with that.

Those are the big things but I guess in closing, a few other stuff, if you are going to start an energy-type committee in your community or your district, I think it's important that you have public buy-in, whether it's from the political side. That's definitely where all your findings are going to come from. You want some citizen involvement and you want some staff involvement, and that's really worked out well with us.

I've just touched on the things that we've done here at the plant but we've done a lot of energy things through street lights, through the public works department, brand-new fire department. It's quite green. So, those are my little tidbits. I think that's it, isn't it, Cameron? Yes, that's it. So, without any questions, I guess?

Hichem Hadjeres: Yes, thank you so much, Howard, for a great presentation, it's always a pleasure.

Howard Carter: It's hard sitting behind the computer. I'm used to be interactive with you but it is what it is.

Hichem Hadjeres: I totally agree. So, Howard, like Wendy, we're just going to go over some basic clarifying questions and then we'll get to some of the more meaty questions later. So, can you speak about energy recovery potential using anaerobic digesters and CHP for a small-scale less than 5GD wastewater treatment plant?

Howard Carter: I can. I have looked into that in the past and I still may look into that. The one reason we hadn't, and it's really not that big in Maine, there's only a couple facilities, is that we just didn't really have any natural gas to do any backup on that. I know the technology's advancing quite a bit so I'm not the best one to answer that but I know what's out there, that's for sure.

Hichem Hadjeres: And I believe there was another clarifying question. Which of these many process improvements have been most cost-effective, dollars spent per kilowatt hour saved? Which facilities prioritized to maximize your limited budget?

Howard Carter: Oh, I think the biggest bang, and I think Wendy even touched on that, is in your aeration system. You definitely want to make sure you have good diffusers if you're going that way. We started out with ceramic diffusers, we switched to membrane, although I hear some scuttlebutt that ceramic might be making a comeback. I don't know how but apparently they are. And make sure you have very energy-efficient blowers.

We have some multi-stage centrifugals right now that we're replacing. We actually got a grant from Worth last year and we went out to Kansas City and looked at some innovator blowers, which is actually just the baby version of the turbo Xs that Wendy showed. Very, very efficient, they actually use these for turbos on race cars and stuff. And we did get a grant from Efficiency Maine for that project, that upgrade project, for $50,000, which are just on hold now because of the whole COVID thing. But by far, it's your aeration systems, not question about that. It's good for a 30-year...

Hichem Hadjeres: Wonderful. So, we'll move on to the next part of the section. Howard, thank you again very much. We will go to a general Q&A session but I wanted to share some concluding thoughts. First of all, as best you can everyone, please give Howard, Wendy, and Shannon a virtual round of applause. I'll do it in person, I couldn't figure out where the applause button was on my platform so I'm just going to do it in person.

But truly, what I really appreciate, and I wanted to share some thoughts about this, but what I really appreciate about our speakers is what the idea of setting energy savings as a priority, especially moving towards net zero or even energy positive, what those implications are for the facility itself but also for the community as a whole. On the one hand, you have the facility-level guidance. You are monitoring, you are putting your finger to the pulse of your facility, analyzing energy usage data, and using that to improve future operations and guide future upgrades.

And through that process, you develop energy data management tools, you attempt to streamline everything. And then on the other hand, you have the other side of the coin which goes beyond the facility, where you integrate the facility planning into broader community energy policy. So, in that case and in all cases really, investments are no longer facility-specific but they are for the community as a whole.

So, a big challenge I've noticed in our industry is that often, it's difficult to convince top leadership that we should get this really important upgrade. And the reason for that often is that it's seen within the facility, not with a broader community in mind. And especially the move towards energy recovery or in the case of even renewable energy power, you see how these things are not isolated to the facility and they're not isolated in an island.

So, on that front, and what I've seen from Howard and Wendy and

for the facilities out there, big and small, when you are investing in your facility, whether it's an energy recovery system or a new type of software, that is not a $5 million, $10 million, or even $50 million investment in the facility. That's a $5 million, $10 million, $50 million in the entire community as a whole.

And hearing from both Wendy and Howard just how important it is to really involve all stakeholders in the planning process, this is a public good so everyone within the public, everyone who has skin in the game needs to be involved, whether that's the operators, whether that's the public, whether that's political leadership.

I hope that especially with the emphasis on renewable energy and energy efficiency that our industry moves towards more of an integrated ecosystem approach, where we do not see the facilities as just treating wastewater, but they're really part of a whole supply chain of waste and energy management that go beyond just a facility.

And we see that, of course, with the fact that our facilities are not called wastewater treatment plants anymore, they're called water resource recovery facilities, and essentially, that's what they are. So, I will leave it at that, and to segue into that, Shannon will actually talk about what the DOE is doing on this front and how we as DOE envision the future and how we want to work with our day-to-day heroes, such as Wendy and Howard and all of the other operators and facility managers out there. So, Shannon, the floor is yours.

Shannon Zaret: Perfect, we can go to the next slide now. Okay, so as I promised, I wanted to chat a little bit about what our next steps are going to be. And so given the success that we had with 1.0, we wanted to continue this momentum by helping facilities beyond that initial accelerator leverage the tools that were developed. And so specifically, the second phase of SWIFt, which we're calling SWIFt 2.0, will focus on reaching 100 additional facilities who voluntarily commit to the 5 percent short-term, 25 percent long-term facility-wide energy savings.

And there's also a second prong to this, we will also be providing technical assistance to 25 facilities who are ready to implement at least one next-generation measure. So, resource recovery, renewable energy technologies, energy storage, advanced data management and sensing AI, just to give some examples. So, if you have any questions on this opportunity, my contact

information is going to be presented at the end. Please don't hesitate to reach out, as well as if you have any questions about the original toolkit information I presented. And so with that I think we'll get started with our Q&A.

Hichem Hadjeres: Right, next slide, please. So, again, really engaging audience, it's truly a pleasure having you all. I hope one day to meet you all in person, maybe at the next Better Buildings Summit. But I guess we can....Let's see, right, so first question for Wendy, how did your involvement in SWIFt 1.0 help your facility set energy management as a strategic priority?

Wendy Anderson: Sorry, I had to unmute myself. Well, I'd like to say that it was momentous or highly influential in changing our behavior. We joined SWIFt with a lot of good intentions, kind of like joining the gym and you had every intention of getting in shape. We had an energy management initiative which we spawned before SWIFt took effect at our facility, and we saw participating in SWIFT as complementing this energy management initiative.

But it became more of an energy efficiency capital development project, mainly because so many major construction projects on our facility, what we had going on, just provided little to no opportunity to impose major process changes. People just couldn't take one more challenge on top of trying to operate a plant with limited capacity due to the construction projects. We're also battling the formation of struvite throughout our facility. A lot of wastewater treatment plants are familiar with this problem.

These are deposits of ammonium phosphate that deposit on the piping and actually restrict flow of your wastewater solids. So, we're currently working on a phosphate recovery system that'll extract the phosphate and actually make it into a fertilizer. But nonetheless, SWIFt was there hovering and reminding us that we needed to implement or try to implement methods in which we could save energy immediately and not wait for the implementation of these long-term energy saving capital projects.

Hichem Hadjeres: Wonderful, thank you so much, Wendy. Howard, the next question is for you. How did you determine which advanced energy savings and recovery strategies would work best for your facility, and what stakeholders did you engage with?

Howard Carter: I think that one I touched on a little bit. I think in the energy thing that we went through there, of course, we're always looking for

return on investment and I always like, especially in the wastewater field, to be under ten years. But whatever can help improve process improvement, that's really the driver there, because to us, treatment is paramount and energy would be second, like replacing your blowers or your diffusers or anything.

And I think with any energy program you want to look at the low-hanging fruit first. What can you do to conserve energy before you try to generate renewable energy, I guess, before you start putting up solar panels or putting up windmills or whatever. You try to just do your own energy efficiency within your pump stations in your plant. That's it, VFDs, basics stuff, VFDs, good drives, aeration upgrades, those types of things, heating units, heat recovery units. And the key stakeholders would be, well, we have Efficiency Maine and the State, like I said.

A lot of times if you're going to put in for an upgrade, you let them know in advance and they'll give you a refund on a lot of things you do. There's certain criteria that you have to meet and it's a very good program that works for us. And that Efficiency Maine is funded through the power companies like Central Maine Power, that always put a portion of their revenues into that.

Hichem Hadjeres: Awesome, and you have a quick follow-up question, maybe a little bit technical but I'll go ahead and ask it. How will you be right-sizing your new blowers and can you explain how the heat recovery insulating unit works in more detail?

Howard Carter: What happens in heat recovery ventilators is I think these water folks have them in their homes now because as you're process-building or whatever, you're always bringing in new fresh air to displace the follow air, and as the new air comes in, it actually goes through a flume and the duct work is heated so the heat passes through. As it's leaving it's pre-heating the air coming in so there's actually two different flow streams in there. I wish I had something I could show you better than that.

What was the other one? What was size? Yeah, so with that, we looked at VOD loadings over the years and where we're at and our blowers now are a little bit oversized. These new innovators or turbo X minis you can call them, actually, they have a turn-down ratio that's quite a bit more than your standard multistage centrifugal. And a good thing with those, unlike the big multistage, is once those shut off they've got to wait a while to turn back on, like 15 minutes, where these could come off and say if

you wanted run off ORP or ammonia or a different type of parameter than DO, you could turn those on and turn them right back on and save energy. A lot of folks are starting to do that now. It would be basically on VOD loadings to determine the size.

Hichem Hadjeres: Wonderful. Wendy, the next question is for you. This is going to be an amalgamation of I think five different questions but I'll try to put it together. So, broadly, what considerations can other facilities seeking to replicate your data management methods take into account? And there were a lot of questions on metrics actually, everything from kilowatt hour per VOD were moved to energy metrics. So, basically, for a facility that wants to replicate or look to your facility, how would you recommend they set themselves up?

What metrics should they establish? What steps can they take? And maybe I'll add this one in myself but you probably answered this already, how do you consolidate everything? And I think you've probably touched on that briefly with the AI suggestion.

Wendy Anderson: I think what you have to do is decide what metric is meaningful to everybody, not just you as an employee but in your upper management. And that helps get buy-in when they start seeing these metrics that resonate with them. It's funny because the metric that resonates with me is kilowatt hours per million gallon per day, or just million gallons. But for our managers and for our board members, the metrics that resonated with them was kilowatt hours per I think it was like standard family home.

And it turns out all the other metrics, financial metrics and operational metrics that they collect in these board meetings or are published in these board meetings have that sort of metric. So, they wanted to see everything kilowatt hours based on single family residence or something like that. So, I put all of that sort of metric in my reporting just so that it addresses that audience, that upper management audience. But for us in the plant itself it's the kilowatt hours per million gallons that resonates.

The kilowatt hours per VOD can have a lot of bearing, especially when you're comparing aeration systems. Like I said, we have two different nitrification systems in our facility and that's a handy metric for measuring the efficiency of one area versus another one. But for the most part we start collecting kilowatt hours on all these different process units and compare the process unit from one year

to the next, and make a few changes, not too many, and see what sort of improvements you meet from one year to the next.

And to do that, as I mentioned, you have to have a lot of submetering, and it's a lot of data entry and paperwork, and frankly, it's hard to keep up with and do your regular job too. But it's a necessary evil that really adds value to your energy conservation efforts. I hope I answered the question.

Hichem Hadjeres: Great, that was a really good answer, thank you. I think you touched on a very important point, which is, again, what matters to your local government, what matters to the people that your serve? And I think we're starting to see more of a trend and it's been a trend but really picking up recently, the idea of really engaging all stakeholders or engaging anyone who is affected by the operations, which is basically everybody in a community. So, again, looking at wastewater treatment as part of a system, part of an integrated ecosystem for energy recovery and waste management.

So, I think you hit it right on the nail. So, we have about one minute. I guess for both Howard and Wendy, any closing thoughts on how you as facility managers, with the plans you have in mind, what are some of the next steps moving forward? And what are some of the challenges that you see, especially when it comes to securing buy-in from the state and local governments to move forward with your energy management strategies?

Hichem Hadjeres: Howard, would you like to go?

Howard Carter: Sure, I think the key has always been, whether it's for energy or your processes or anything, you've always got to keep moving forward. Doing nothing is going backwards so every year you've got to try to do something going forward. I'm really excited on the energy front for the future, I'm really excited about where this hydrogen could go, especially with the use of wastewater. You have these facilities in almost all communities that could really help generate power or generate heat.

Still the digestion's out there, a lot more people are starting to go into that, and just new levels of treatment. We could be looking at a significant upgrade here due to sea level rise that we're studying now being impacted. So, yeah, I think just the newer technologies. We touched on artificial intelligence, that's certainly happening all over the place, doing more with less. But at the end of the day, even though there's artificial intelligence, you still need people out

there to see things, to touch things, to smell things. So, always keep that in mind as well. Nothing like the human presence in some of these places.

Hichem Hadjeres: Wonderful. Wendy, any final thoughts?

Wendy Anderson: I was just going to say that our facility is very large and yet we've always had a policy of staying out of the limelight. We're just kind of unknown and we busily do what we do and don't get into papers or anything like that. So, people hardly know we're there even though we're a massive footprint in northern Denver.

And lately, we've started to engage the city and state officials around us and try to get more communication pathways open between our different entities, and we found that we're way behind, actually, that the city and the state are way ahead of us when it comes to establishing sustainability goals and establishing forward-thinking methods of trying to cut back on greenhouse gases and improve sustainability.

So, our job is quite easy, when we walk out we're preaching to the choir. Those guys are already on board and ready to do what they can to assist us with our sustainability goals.

Hichem Hadjeres: Wonderful. Thank you so much, both of you. I know, again, the audience had a lot of questions about how to follow up and I believe at least one person expressed interest in SWIFt 2.0 so I'll keep this brief. First, please follow up on our social media handle, #BBSUMMIT2020, and our LinkedIn page, Better Buildings and better plants. Next slide, please.

Just as a quick overview, we'll be having a webinar series for all of you to stay in touch and feel free to register on the Better Buildings page. This will help you stay in the loop and keep in touch with us, but I would also direct you guys most importantly to the Better Buildings solutions center.

Next page, please. So, this is where we will actually have the toolkit and we will have all the SWIFt 1.0 resources and I do believe that there were a few questions about SWIFt 1.0 so a lot of the information can be found there. So, feel free to visit and again, if you registered we will be able to reach out to you and update you as far as the SWIFt 1.0 toolkit and the eventual SWIFt 2.0 launch. We really look forward to having you guys use these tools and engage with us.

We also have a monthly newsletter so, again, just stay in touch and please, by all means, visit our page and join our list.

And next slide, please. There's a brief video about Better Buildings.

[Video plays from 1:26:54 to 1:27:40]

Thank you all again very much for joining our session and thank you to our wonderful speakers. Please subscribe to us at energy.gov/EERE/SLSC. Please also contact us at stateandlocal@EE.DOE.gov. And lastly, we have all of our contact information there. Please, if you'd like grab a screenshot and if there are any questions about SWIFt or any of the other speakers' presentations, please feel free to reach out directly.

Once again, thank you to all who have participated, to our speakers, to our attendees, to the program support. This has been a truly wonderful session and would not have been possible without all of your involvement. So, with that, we conclude our session for the Better Buildings Summit. Again, we hope to stay in touch and we look forward to having you guys join us again next year. Thank you.

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