Maria Vargas: Good afternoon. Good morning, everyone. Welcome to one of our special events at this year's 2021 Better Building Summit. We are here for the Virtual Building Tours, and it will be, I promise, a very exciting session. For those of you who don't know me, my name is Maria Vargas. I'm the Director of the Better Buildings Initiative here at the US Department of Energy.

If you were able to join us for the opening plenary, I teed this session up and I want to do that a little bit here as well. When we're not in a pandemic, when we can travel, one of the things that we have really enjoyed doing at the Department of Energy is getting out and seeing our partners work firsthand.

We do site visits around the country throughout the year, because we want to not only see what our partners are doing and learn from them as we tour their buildings and plants, but we also want to make sure the word gets out on what people are doing, so that not only folks in the communities where these buildings and plants are understand the work that's being done and the leadership that's being demonstrated within their community, but it's also a chance for others to learn from the work that's been done.

Well, 2020 was an interesting year and we weren't able to travel, but the partners today stepped up and worked with the Department of Energy to do some virtual building and plant tours, and we are very excited to share with you those building and those plants and the work that's been done.

Before we jump in and I turn it over to the speakers, I just want to remind folks of a couple things. This is a session that's being recorded and it will be available afterwards on the Better Buildings Solution Center. So please check it out or, if you think this is a great session, refer your friends to listen in.

If you have audio/visual problems or issues, please do go ahead and send a message in the chat window located at the bottom of your Zoom panel.

With that, I want to lastly ask everyone to make sure that they are logged in and using the virtual interactive platform that we're using for the summit, and that it Slido.com. You see that on the screen right now. The event code is #DOE. Of this session is entitled "Virtual Building Tours."

So without further ado, I want to turn over this really special session, which is going to give us a look into the inside of three

Better Buildings, Better Plants partners, and turn it over to our partners to give you their tours and highlight the innovative technology and practices that they have implemented in their facilities.

The way it's going to work is that I'm going to ask each partner to share. We have a short video and some slides on each facility or each plant. Then after each of the partners speaks, we have left plenty of time for questions. So please, again, go to Slido.com and type in your questions. You can also upvote questions. So if you see other questions on Slido.com that you think would be great to hear answers to, please upvote those and we will try to get to all the questions that people submit.

With that, I'd like to turn it over to our first speaker today, Michelle Croal. Michelle Croal is an energy manager at Ford Motor Company, and she's been supporting nonmanufacturing facilities primary in southeast Michigan. She's been with Ford almost two years and has held various project and operation positions. She's an engineer in the oil and gas sector.

With that, we'd like start with a short video on Ford's energy work before I turn the microphone over to Michelle. So with that, if we can roll the Ford video, I'd appreciate it. Then, Michelle, the floor will be yours. Thanks.

[Video plays from 0:04:02 - 0:05:07]

Michelle Croal: Great. Thanks, Maria, for that introduction and for the team at DOE for helping put together that awesome video. So let's dive into a little more detail with the Central Energy Plant at Ford's Research and Engineering Campus in Dearborn, Michigan.

The CEP is a combined heat and power facility that started operation in December 2019. It serves 6.5 million square feet of research, lab, and office buildings in Dearborn, Michigan. It provides electricity, steam, chilled water, and hot water.

The plant consists of two natural gas-fired turbines that generate electricity, each of which is coupled to a heat recovery steam generator or HRSG to generate steam. Excess steam can be used to produce additional electricity through a steam turbine generator or STG.

Hot water is generated through waste heat recovery, and chilled water from a chiller plant. Thirty-four megawatts of electricity is provided to Ford and the public grid.

The plant employs six operating engineers, one instrumentation technician, and two facility managers working 24/7. Energy efficiency efforts at this facility were focused on getting as much use out of the BTU as possible, integrating the facility for multiple paths of heat recovery, and multiple configurations to run equipment based on Ford's needs.

Some of the innovative technologies that were used were the extensive 3D modeling in the design phase that has become the basis for the digital twin. Also the development of technology, which allowed switching legacy hydronic systems from glycol to water, which is more efficient.

Some of the sustainability objectives for office space were a 50 percent reduction in carbon footprint, a 50 percent reduction in water use, a 60 percent improvement in chilled water production efficiency, and a 100 percent space heating from recovered waste heat.

So if we start our tour at the east side of the plant, the top left corner there, you can see this is the main entrance, and you can see those really large windows that provide a lot of natural daylight, which is unusual for an industrial facility. The building itself is LEED Gold certified, as you saw in the video.

If we walk around to the north side of the plant, you can see the thermal energy storage tank. This is a five-million-gallon tank, which stores 42-degree Fahrenheit chilled water, to use to offset peak electricity costs between 11:00 AM and 7:00 PM.

In the future, the chilled water from the Central Energy plant will replace distributed chillers across campus providing building cooling needs. It also uses extremely low global warming potential refrigerant compared to the legacy chillers on campus.

If we step inside the plant for just a minute, here we can see the steam turbine generator. This is where we can send steam to generate additional electricity. The condensing heat exchanger utilizes hot water return from Ford Campus to condense the steam exhaust while generating free hot water for campus building heating.

If we step back outside, underneath the parking lot and the walkways we the snowmelt system. This has been a big win for us operating in the last year, because we can reject additional waste heat from the steam turbine generator to the snowmelt system and offload the cooling water towers. We're estimating about two million gallons per year of water savings.

Finally, on the west side of the plant, we see some of the condensate tanks. As you may know, condensate return is really important for the energy efficiency and water use associated with steam production, with higher condensate return being better. Our plant sees about 85 percent condensate return.

So go ahead and next slide please.

Here you can see the progression of the plant over the last few years from design, construction, and operation. So on the left side, we have the 3D model of the HRSGs. This is part of a larger 3D model of the plant and it's actively used as part of a digital twin, which acts as a repository for design and equipment records, live operating data that operators can actually access while they're out and about in the plant with augmented reality. In the future, advanced analytics, pattern recognition, and predictive operation.

In the center, you can see the combustion turbines and the HRSG staged in place. A large majority of the components for the plant were prefabricated offsite and then put in place, which is a lot of the success during construction.

Then finally, we have the HRSG in operation, with the combustion turbine towards the left of the picture with the HRSG in the center. There is a duct firing control skid towards that center there, which can be used to boost steam production if needed.

We really hope that you can come visit this amazing facility in person in the future.

Maria Vargas: That's awesome. Thanks, Michelle. We really appreciate it. Folks, if you've got questions, go ahead and type them in into Slido so you don't forget them, and we'll try and get to them. Thanks again, Michelle.

I'd like to now turn it over to Jim Henry. Jim is the Global Compliance Manager at Iron Mountain Data Centers. He manages compliance with various international standards, ranging from energy and environmental standards to information security, business continuity, and cybersecurity. Not a small job.

With that, Jim, go ahead and take it away.

[Video plays from 0:11:29 to 0:12:32]

Jim Henry: Awesome. I'll echo Michelle's comments that hopefully in the near future we're able to get the DOE team onsite at one of the datacenters, hopefully my favorite one that I'm going to talk about, without being too biased.

Just a quick, brief overview of what a datacenter is, for those of you who may not know. Any time new software, applications or technology is developed, it's got to live somewhere, right. When you have a cell phone, when you have a computer, you've got a datacenter problem somewhere. We are the cloud is what I often tell people.

There's a couple different types of datacenters, too, and that plays into an important kind of part in the Iron Mountain story. You have datacenters that are totally proprietary. Those are the ones that some of the folks on this call, you might have a datacenter in the basement of your office building or in your closet. Those are tough to keep efficient when they're in your own building.

There are total cloud datacenters. Large cloud providers, your Google Drive and everything, those live in proprietary datacenters where the IT equipment, all the racks and servers are controlled. The hardware and software is controlled by who owns the building. That makes it a little bit easier on the energy efficiency side, so I'm a little jealous.

But then in the corner, there's co-location datacenters. What a co-location datacenter is is exactly what it sounds like. You're co-located with all kinds of other industries. So in the photos we're looking at right now of Kansas City, there's that bottom left-hand corner. So if we were standing in this room today right now, that room would be filled with servers, cages separating those server racks, co-located together, banking industry, healthcare industry, government, streaming, entertainment. So there's all sorts of things.

We don't actually own the IT equipment. We rely on our customers to make decisions about what they need to move their gear in. We make sure it's always on, always secure, and always sustainable. That's kind of our goal.

So with that said, the way that we operate is largely in hand with reducing the overhead in that equation that is between our customers' utilization and then how we cool it, what we need to do to power it and make sure it's always on.

So in the Kansas City datacenter, the photos you are looking at right now, you're seeing a couple of things at play. It mainly just looks like server racks. If you've seen one datacenter, you've seen them all.

In Kansas City, unique to another one of our sites, it's actually underground. So we have two underground datacenters. This is a much smaller one. The ambient temperature is about the same year round. It's agnostic to the seasons.

But no matter what, in a datacenter you have air moving around. So in Kansas City, we've done large retrofits for LED lighting. We've done a lot with air management, making sure floor tiles like you see in the photo are put in the right places. That hot and cold aisle containment is actually set up in the datacenter.

Then of course that's an iterative process. So when we talk about projects, and I'll talk through this as we go through the slides, you're really never done in a datacenter. You could move a chiller plant in. You could update some infrastructure. But still, you're never really done because conditions always change.

We're not manufacturing everything, so it's not like we have a steady assembly line or we have a steady schedule that we can follow. IT gear has peaks and dips and everything else, depending on process power. So you're always dealing with all sorts of things that make this an iterative process.

Next slide please.

Again, this one is not underground and it's a very new facility. This was built in 2017. This is in northern Virginia, in Prince William County in Manassas. This is a large datacenter. It's actually a campus that's built out for four buildings.

In the datacenter particularly, when you have a new building – and this is a struggle I think in any industry – you're like, "Where do we start?" All this infrastructure is new. There's no antiquated capital projects that we need to do and everything should be working as appropriate. So we assume that, too.

Of course, as we have customers filling up these large rooms, like you see in the bottom left, and we've got these gigantic building – and by the way, just in case anyone was curious, when you have a datacenter, you see those windows in that middle photo. You really only have windows in office areas. If it's a high-secure facility, which all of our datacenters are, in the actual computer rooms you can't have windows. It's an added risk that you really don't want to introduce to the environment. So with windows and things like that, it's a totally – these are totally closed rooms.

So all the infrastructure was brand new. The static switches, all of our substation gear, the chillers, the air handlers, everything was brand new. So what we did was strategically deployed our customers in ways where air management from the jump was taken care of.

So if our customers were running very dense loads in their datacenter racks, we didn't wait to put cold aisle and hot aisle containment in. It happened from the beginning as a best practice. Then we tuned the building management system to meet the demands of the load data haul by data haul.

Not only that, but some of the other challenges we found was that some of our customers had legacy IT gear. So if you're familiar with a server or a switch, you see things blow front to back. Some of the gear was blowing side to side. So we utilized kind of an opportunity here to create custom ducting and duct work for the datacenters.

Then lastly, we've also engaged an AI company to run the data in our building management system. Since everything is new, we wanted to see how we could optimize our operations.

Next slide please.

I've only got a little bit of time to talk about this one, but it's super-neat, so I'll just talk about the one focus. This is the western Pennsylvania datacenter. It's north of Pittsburgh. This is actually about 20 minutes from my home, so it's near and dear to my heart.

At this site, we have an underground lake. I'm not kidding. We are 280 feet underground. The lake is part of the Pennsylvania natural water table. It's completely segregated. It doesn't have any inflow or outflow. Rainwater doesn't affect it. It's about 57 degrees year round.

We utilize that to cool the first phase of the datacenter. So it's a closed loop system. We also utilize free cooling in the wintertime to bring in cold air.

Then of course in the datacenter itself, in the small photo that you can see in the bottom middle, we utilize cold and hot aisle containment in addition to all these efforts, and tuning the building management system to really maximize the power utilization effectiveness of the total site.

So there's a lot of unique things about datacenters, but to put a bow on it, datacenters are a massive user of electricity. So not only do we purchase meaningful local renewable energy from various projects and suppliers, but we also understand that the greenest kilowatt is one that isn't even used. So even though we're buying renewable energy and we also generate onsite renewable energy at some of our other sites, we also aim to use all of that renewable energy in the most responsible way possible.

With that, I'll kick it back to Maria.

Maria Vargas: Awesome. Despite the fact that I have seen these tours already, I'm still taking notes. I was just thinking the underwater lake surely would be a real in person site visit many of us I'm sure, not only on the panel, but that joining us today would like to do. So thanks so much, Jim. We appreciate it.

Folks, if you've got questions for Jim or Iron Mountain Data Centers or any of the work that you just heard about, please feel free. I know some questions are coming into Slido. So please feel free to send your questions and we'll get to as many of them as we can. So thanks again, Jim.

Now our third virtual site visit is in the state of Maryland. David St. Jean is here to talk to us. He's the Director of Energy and Sustainability at the Department of General Services for the State of Maryland. His office purchases all electricity used by the state government. He manages the State Energy Performance Contracting Program. He chairs the Green Purchasing Committee, manages the state energy database, and is the go-to office for state agencies on energy-related matter.

So as you can imagine, quite a large portfolio, lots of things going on. So you've got David here, so feel free to ask him questions.

David, we're going to start with a quick video on the state of Maryland's work and then we'll turn it over to you. So if we can roll the video, that would be great.

[Video plays from 0:22:05 to 0:23:10]

David St. Jean: Thank you for that introduction, Maria. I actually got kind of tired listening to all things we do in the office. It was exhausting. I think I'll retire tomorrow.

Maria Vargas: There you go.

David St. Jean: It's tough to follow a presentation with an underground lake and an underground datacenter, but I shall do my best. I guess just briefly, we'll talk for a minute about our participation in the Better Buildings Challenge, because if there are any other state participants on the call, everyone always wants to know how you save energy in state buildings. How do you get management behind it, et cetera?

Part of the solution I think was joining the challenge, because that got management more interested in what we were doing. When we joined the challenge, with joined it with 9.8 million square feet of state buildings, 69 buildings.

Most of the savings were achieved through Energy Savings Performance contracts. In particular, a couple of state hospitals did exceedingly well. One of them, a million square foot hospital, saved 55 percent of their annual energy use. But even without that, there was an 18 percent savings overall through that portfolio. So it's been a very good experience for us, and I think it motivated us to achieve even greater savings than we would have otherwise.

Can you go to the next slide?

So let's talk a minute about the railway station itself. As you saw from the video, that station is over 100 years old. It was built in 1853. This is Cumberland, Maryland. Anyone who has heard of the Cumberland Gap, there's a gap in the Appalachian Mountains where three, at the time, major transportation routes went through that area for anyone traveling from the east to the west, from the mid-Atlantic states.

So there was the national road there, which was America's first highway, the B&O Railroad, and the C&O Canal. Then finally, the Western Maryland Railway company started in 1853, built the railway station in 1913, and it remained as a passenger terminal until 1958.

So this project itself started – this was around 2012, when I got a call. I was working at the Maryland Energy Administration at the time. I was a program manager. I got a call from the director of Canal Place, complaining about HVAC equipment that was falling apart, very, very drafty buildings. You can imagine; it's 100 years old. There was virtually no insulation. The windows were all single-pane windows, wooden windows that leaked air year round. They had humidity problems. It was a bit of a mess.

The building had been upgraded in 2000, but I think they did sort of a bare bones upgrade. They put in the HVAC system at that time.

So at the time, we had a Department of Energy grant to hire auditors, and we sent some auditors up there to look at the building. They came back with a report talking about an HVAC system that was at the end or beyond its useful life, leaking refrigerant lines. As you can see in the picture on the right, all the outside units were corralled into this little, tight spot, because it's in a storage building and there was limited space where they could be put. So there were a host of problems.

At the time, I ran a loan program at Maryland Energy Administration that helped finance these energy efficiency projects for state-owned buildings. So we were able to pull some financing together. I went out there and addressed the lighting problems. We pulled out all of the existing HVAC equipment, which was a challenge, obviously, getting all of the refrigerant lines back out of the building, putting new ones in, and maintaining the historic structure itself. We also right-sized the HVAC system because, like most HVAC systems, it had been oversized by a considerable amount.

We used the MEA loan to address the insulation and lighting improvements. We used some other capital money to put in the HVAC system. And the final result was a 21 percent annual energy savings and a $12,100.00 a year annual cost savings.

We did all that while the station was still in operation. So it was minimally invasive, I think. I think the end product is they have a much, much more comfortable building and it is running much more efficiency.

Thank you. I think that's all I had to say.

Maria Vargas: Awesome. Thank you so much, David. I appreciate it. Again, I'm over here taking notes, so thanks.

Now, we're just going to open it up to the Q&A part. I thought we'd start with our – what's the word I want – the lightest question we got. Jim, someone wants to know if Batman lives in western Pennsylvania.

Jim Henry: I do live 20 minutes from Boyer. So yes, Batman does live in western Pennsylvania.

Maria Vargas: So there you go. I just thought I'd – there you have it. Okay. Now I'm just going to read through some of these questions. Some are specific and some are for all three of you.

With that, Michelle, a question for you, and that was if you could explain the concept of digital twin. People were interested in exactly what you mean by that.

Michelle Croal: Sure. The digital twin is almost like a model or a virtual representation of the plant. There's different components to it. So we took the 3D model that we used during design phase. It has detailed engineering design of all the equipment. Then we layered on top of it live operating data that operators can access, out in the plant even.

It also has the work order and maintenance system layered on top. In addition to that, some of the analytics and predictive operations are going to be coming soon, for example, looking at weather and bringing that into the plant to see if anything needs to change. For example, putting smart sensors on our steam traps that notify the operators when those steam traps fail, so that they can immediately go out and fix them instead of waiting many weeks while that steam trap has failed and you're losing energy efficiency there.

Maria Vargas: Thanks, Michelle. See, the drag about virtual is that I can't turn to the person who asked the question on Slido and say, "Got it?" but I think that answer was great, so thank you so much.

Jim, a couple questions for you. One is pretty straightforward, if you can explain what's a hot/cold aisle again. Then I think there was another question. Let me just read it to you. Part of the challenge is I have to scroll here, but I thought that that was interesting too, so I'm going to give you two questions at once. Hot and cold aisle, if you'll just describe what that is again.

Then this was another question for Jim. "Was the Pennsylvania datacenter location chosen specifically because the lake was there? How do cost savings from this facility compare to those without a place-based temperature regulator?"

Great questions. So hot and cold aisles first, and then a little bit about the Pennsylvania location.

Jim Henry: Awesome. So yeah, hot and cold aisle, basically what that means is that when you're looking at a datacenter, let's just say it's a closed room, you don't want hot and cold air mixing with each other, because then that return air that has to go back into the cooling system is just making the cooling system work harder. Then you'll have to ramp up fan speeds and your infrastructure is using more electricity.

So if the air that is actually moving up into the servers is cold and then it doesn't mix with any hot air there, then the coldest air is going into the servers. Contrary to popular belief, datacenters can be like 80 degrees. They don't need to be super-cold like most people think.

So cold air comes up, gets sucked into the servers. Then the hot return air can go back into the plenum. All that air mixing together is not really great for the equipment. It makes it work harder. You use more electricity. So when you start actually segregating that air, you're running a more efficient operation because it's not mixing together.

Basically, when you look at building a datacenter, you should be using computational fluid dynamic software to see where those – like what those hot and cold aisles look like temperature-wise. Then that can factor into kind of what Michelle was describing, where you have a digital model of what temperature that actual center or building is running at. So you can tweak the building management system, tweak your chillers, and then tweak your infrastructure to make it maximize as use as low amount of kWh as possible.

Then on the datacenter side, I would normally say that, yes, the location was chosen, but Iron Mountain already owned the property. Iron Mountain is an information storage and management business. We've been around since 1951. We've got over 1,500 facilities globally in 50 different countries. But the datacenter division is much smaller.

So we already owned the mine – it's a retired limestone mine in western PA – for records management. When we got into the datacenter business back in the early 2010s, like 2009/2010, it was a natural choice to put that datacenter there by that lake, because we could use it for the geothermal cooling system.

Yes, obviously we do have more energy savings than a traditional datacenter, because we don't have to use additional infrastructure, like an additional chiller plant in place of that. We're also in western PA where it's really cold in the wintertime and in the spring and fall. So we can use the free cooling.

Now what I will say though is that as datacenters are datacenters, our mission is to scale as technology advances. So savings are subjective. You may have really good savings from a project, but then just by iterative design you're adding more infrastructure. So then you'll actually be using more electricity, but it's really about bringing the delta between total facility utilization and IT utilization as close as possible.

Maria Vargas: Awesome. Thanks, Jim. I appreciate it.

Okay. Here's one for David. David, the question said if you could just elaborate quickly on multiple grants and fund sources and how they fit together.

David St. Jean: Ha-ha.

Maria Vargas: That's the answer, right. No, just kidding.

David St. Jean: No, that is the answer. That's pretty close. Well it really depends in this case of the fund balance in the loan program at the time, the timing of it at the time. We have a couple of different programs in Maryland for zero interest loans for state buildings. Then there's always the State Treasury, lease money available for capital projects. Then of course general funds generally is a last resort.

But that particular project used the zero interest loan money from MEA for the lighting and the insulation and air ceiling. Then the capital funds went into the HVAC replacement, because the HVAC had gotten so bad that before the whole project could be pulled together, it ended up being an emergency replacement. So it ended up being capital funding.

Maria Vargas: Great. Thank you. This one is one of the two top upvoted questions, and this one is to all three of you, so you can pick who goes first. If you could do this project all over again, what would you do differently? Actually, the question is, "What is something you would do differently?" but I decided to just riff on that as a moderator and give you a little bit more flexibility. So there you go. Who wants to start on that one?

David St. Jean: I can start doing this, because it's a simple project with a pretty simple answer. I think doing it differently now, looking at the state's interesting in decarbonization, electrification of its buildings, I would probably model the VRF system and see how that could have been worked out into the scope.

Maria Vargas: Cool. All right. Michelle, what's one thing you would have done differently?

Michelle Croal: Well, for this project, we had a lot of really strong collaboration between DTE Energy and Ford Motor Company and the architecture and engineering company that was involved. It was really beneficial to have the future plant operator involved in the design. Maybe that doesn't quite answer what we would do differently, but we would recommend that if folks want to do that, it results in a really good product at the end.

Maria Vargas: So you were pleased with your process.

Michelle Croal: Mm-hmm.

Maria Vargas: All right, Jim.

Jim Henry: It's an interesting question from a datacenter perspective because I've got three datacenters, one of which is kind of a constant project, so I'll just talk about that one. When you build a datacenter, of course every couple years there's better infrastructure that comes out as far as chillers, computer room air handlers, pumps, more efficient infrastructure.

So even since we built the datacenter in Manassas, there have been advancements in some of the cooling infrastructure that's come out. So it's not like we could have changed anything in the design process then, but of course you can always make upgrades.

Really, like I said, the western PA datacenter is always a project because you're looking at lake temperature. You're looking at tuning that system to meet the demands of the IT equipment in the datacenter. So really, it's about just making sure that we're staying on top of that at scale and tuning it over time, which a lot of that revolves around our – we have a dedicated datacenter, kind of an operations management team, aside from the folks who actually run the datacenter. The folks who run the building management system are looking at ways that they can optimize.

Really, it's all about data, making the data available to our technicians in the datacenter at any given time, so they can look at all of the temperatures, all of the levels of the water temperature and things like that and tune it according to what's going on inside and outside. So it's kind of an iterative project. We're always doing things differently. It's a project that's never done.

Maria Vargas: Interesting. Okay, great. Michelle, I have two more questions for you. I'm going to do what I did for Jim, which is two questions. So just take notes. Here are the two questions.

What is the low refrigerant of the chillers at Ford? That was one question. Then the other question was: for Ford central plant, do you use any off-the-shelf software to develop the 3D model or is that a custom developed program built specifically for Ford?

Michelle Croal: Okay. The refrigerant, it's called R1233ZD. I think it was mentioned in the video, EcoWise refrigerant. It has a GWP of 1. If you compare that to like R11, it has a global warming potential of around 4,000. So it's a significantly lower potential environmental impact.

Regarding the other question about the digital twin, I don't know, but I have Jeff on the line as my backup and he might be able to answer that question.

Jeff White: That's great, Michelle. You've done great so far. The digital twin that we used is standard off-the-shelf technology in its beginning. That was generated using AutoCAD and Willow and a few others all mashed together.

As we've gone into the operations side of the equipment, it is a custom package. EcoDomus is a developer that does similar types of stuff. I don't have permission of the company to put their name out there, so I won't name them specifically, but it is custom because it is a powerhouse that is an electric utility that is regulated. So I don't want to get in any trouble with the regulators by putting things out there that maybe I shouldn't.

Maria Vargas: We don't want to get anybody in trouble.

Jeff White: No, we don't.

Maria Vargas: All right, that's great. Now a couple more questions for all three of you. This one doesn't make it clear that it's for all three of you, but I think it has to be. How long before you break even in terms of the extra capital costs, the electricity and the water savings?

I'm going to let you all decide who takes that. Jim, you just did a big breath.

Jim Henry: Yeah. That's a tough one.

Maria Vargas: It depends, right? A lot of it depends.

Jim Henry: It really does. I'd like to say that we've probably more than broken even, because of – well, again, without getting anybody –

Maria Vargas: We don't want to get anyone in trouble.

Jim Henry: Right. But as far as return on investment, the lake really makes things easier. The return water comes in and then it kind of naturally rejects heat. The lake rejects heat. So we're not actually having to cool that water back down. So that's kind of nice.

As far as a chiller, if you say lake versus chiller, it would take a longer time to get an ROI out of a chiller, whereas the lake has probably paid for itself multiple times over. But then again, there's more than just that datacenter running on the lake, and we have another phase of the datacenter that runs on a chiller plant because the lake can't do the entire datacenter. It's only part of it.

So as a full datacenter, it would take some math to do, but I think the lake in and of itself – if everyone could land their facility next to a lake and do geothermal, of course you would. Or if you had a fjord in the Nordics where you could use free cooling and then use a fjord to cool your datacenter, of course you would. But that's just not reality.

Maria Vargas: Okay. Michelle or David or Jeff, does anybody want to weigh in on how – I have to read the question – how long before you break even in terms of the extra capital costs, and electricity and water savings?

Jeff White: I can talk about that a little bit for Ford. This central energy plant is being built – it was built to provide services to the renovation of our new campus. So we're presently – the idea of building a central energy plant started, as I think the video said, about five years ago, when we started announcing that we were going to completely rework and redo our campus.

So there's about 25,000 employees, and there are several different chiller plants. I can tell you that they were 50 years old, plus or minus, and the idea that you've got 50-year-old equipment and you want to provide a good working environment to attract new talent coming out of college, et cetera, you've got to have good, robust equipment. Not to mention that testing is a very important part of rolling product out for Ford Motor Company.

So replacement of old chiller systems was mounting up into the $50 - $60 million category. So there's an avoided cost there. Not to mention the fact that they were distributed around the campus, and the efficiency of distributed chillers that were designed 50 years ago is pretty far up there.

So in simple payback, I know, Michelle, you did a little bit of study on answering that question. As Jim said, it's a very difficult question to answer. When you're building new infrastructure, why do you build new infrastructure? There's a lot of reasons. Cost savings is one of those. Cost savings is not the reason that we built this central energy plant.

We shut down a lot of old chiller equipment. We eliminated a lot of old refrigerants that have – you can't even buy them anymore because they have greenhouse potential issues with them. And we're shutting down a steam plant that was built in the 1950s. Yes, it's an Albert Kahn designed steam building and it's a landmark in the Dearborn area, and yes, we'll have to figure out what to do with the building. But functionally as a steam producer, it's gone.

Instead of burning a BCF of gas as direct emissions, we're now reclaiming that BCF of thermal load and supplying it to the campus as heat recovery activity. So those are the reasons.

Maria Vargas: It's hard because I think people are looking for answers like, "How long for a payback," and I get it. I think maybe, David, I can let you respond, too. I think there's two things going on. One is actually the next question people are asking, which I'll get to in a minute. But I think the other question is understanding what sort of payback period. Is it months, years or decades that your organizations are willing to – I was going to say stomach, but that's not the right word – willing to endure or willing to live with? I think that's part of the challenge here.

So, David, let me just let you respond or Michelle, if there's anything else, and then let me get to the other question that I think is sort of getting at the heart of what you all are talking about in a second, but I don't want to cut off David or Michelle, who might want to have feedback on the breakeven question, how long before you break even.

David St. Jean: I think the question was additional capital costs. So I would define that as the HVAC system had to be replaced anyway. So the additional costs were running load calculations to right-size the equipment. The additional cost was putting in above code HVAC equipment and LED lighting.

So if I was going to look at the payback for the additional cost for all those items, I'd say two years. A very quick payback. If you're looking at the actual payback from installing a brand new HVAC system, it's going to really the life of the equipment, probably, or beyond because it's a very capital expensive project. But it's the additional cost, really, that we need to spend on more efficient equipment that is a very easy to pay back item.

Maria Vargas: Great. Michelle, did you want to add anything to that question?

Michelle Croal: Sure. Just in terms of some of the components of the central energy plant, for example, the thermal energy storage tank, we consider that as having a less than three-year payback. And some of the optimizations that we've done since the plant has been operating, like with the snowmelt system and with an RO feed water heat exchanger that was put in, those have paybacks of six months to a year.

Maria Vargas: Okay, great.

Jeff White: I'll just add to that.

Maria Vargas: Yes, please.

Jeff White: In general, I've been in this job for a little over 25 years. In my career I've been responsible for performance contracting as your primary delivery for energy efficiency projects. Those projects span the gamut of compressed air, HVAC, and lighting, for the most part, if you had to develop three buckets.

The lighting projects, if you go back ten years ago, they would fall into the three to four to five-year simple payback. Then today, because we've done so much lighting upgrades, it's in the four to six to seven-year simple payback, just because the low-hanging fruit is gone.

HVAC is very difficult. It's always been a seven, eight, nine-year simple payback. Then compressed air falls into the same category. So we do a lot of performance contracts in the six to ten-year contract term, and that covers all of the installation, financing, overhead of delivering that project and delivering those savings.

Maria Vargas: Interesting. Really helpful, you guys. I'm very mindful that we have less than ten minutes to go. I know the hour goes by fast, but I think this one gets at the heart of some of the questions, and a I think little bit of what you all talked about a little bit.

That was how do you balance sustainability, resilience, and security in your buildings? So it's monetizing some of this stuff like – okay, I'm not going to riff on this. Let me just read the question and let you all answer it.

How do you balance sustainability, resilience, and security in your buildings? Can you speak to a few examples of these things at play and your decision-making?

Some of you have already talked about it, we had to install – David, I think that was you – we had to install a new chiller anyway. So then the question is – but let me not pontificate for you. Let me just ask you guys the questions. Who wants to take a run at a couple examples of the themes of sustainability, resilience, and security, and how they compete or don't or get balanced as you make these decisions?

Jim Henry: It's a particularly interesting conundrum in datacenters that need all three. Certainly in a manufacturing industry, too, you're also looking at those things as well. So I'm interested to hear what the others say.

Yesterday, ironically enough, the Better Buildings session that I spoke on was about resiliency and how it crosses with energy efficiency. So in datacenters obviously – Michelle, I'm not sure who you guys have your datacenter with, but it's probably co-located somewhere in some capacity, and if it ever goes off that's not good for you, right, because that's probably what's running part of your business, and the same with the state of Maryland. David, you guys probably have servers sitting somewhere, other than maybe some proprietary stuff.

So for datacenters, staying on all the time is primary, everyone in the business, period. Even providers who don't do green things or participate in sustainable practices, their number one focus is going to be staying on all the time. We build that around service level agreements because everyone hates when they go on Netflix and it's not working. We hate the buffering, the wheel of death.

So really, it comes down to – like in the video you saw that Iron Mountain Data Centers were 50001 certified, 14001 certified. We're also certified in the most industry information security and business continuity certifications in the industry. So if anyone on the call has heard of 27001 or NIST 800-53 for the folks in the government or FISMA High, PCI DSS, HIPAA, we are scrutinized on all levels of security for data availability, processing integrity.

So basically what that means is they're all equal for us. It's always going to be secure, on, and green. So balancing the sustainability with the resiliency is a little interesting, because you've got to have diesel generators for backup. We don't like emissions. We don't like diesel. So as an industry, and I think this will hit other industries like maybe the hospital industry in a while, we're looking at more of a model where could we go to hydrogen for backup fuel.

Another thing we think about all the time is we have UPSs, uninterruptable power supplies. We do have to block redundant systems, so that if one fails or if a PDU fails that there's a static transfer switch that can transfer over to the next redundant block, and then a redundant generator in case a generator doesn't fire. There was a diagram in my presentation yesterday that described just that, how redundant the systems are.

Then of course with security, I think it's a little bit off to the side. Security doesn't really inhibit sustainability or resiliency for us. We have to be the most secure facilities in the world – I mean period. This is where healthcare data, personal data, banking data, banking transactions, intellectual property, it all lives in the cloud and it all lives in datacenters. So there's no compromise. It's primary just as the others to you are. It's super-important.

Maria Vargas: Great. Thank you.

Jeff White: I'll add on to that.

Maria Vargas: Go ahead.

Jeff White: The resilience question is hugely important to many companies. Yes, we do have a datacenter and it's a very large datacenter. When we built it, we went to the utility company and said we want two fully redundant, 120 KV supply, and we have diesel generators to back it up, and we have UPSs to make sure it's online.

It's really the same question when we built and went after the design intent for the central energy plant. It is fully capable of black start and island mode operation. We have 40-megawatts of diesel generators on standby, integrated with the central energy plant. Actually, it's 30-megawatts integrated with the central energy plant, and it's fully capable of black start and island mode operation.

That's because if our research center goes down, it's millions of dollars a day. It's actually more than that probably, but it's a lot of money.

Maria Vargas: A lot of money, right.

Jeff White: If something goes wrong there. Michelle, I don't know if you want to add anything else to that.

Michelle Croal: No. You covered it, Jeff. Thanks.

Maria Vargas: David, how do you balance sustainability, resilience, and security in your building?

David St. Jean: Yes. I struggled with that for a second. I thought, "Is that really a problem?" Then I remembered, "Wait a minute. We're negotiating a performance contract at a correctional facility in Hagerstown right now. Obviously, their primary concern is keeping people onsite. If the electricity fails up there, doors start opening, lights go out. Bad things happen.

So layering performance contract and energy efficiency initiatives and ECMs on a site like that is definitely a challenge. We've been able to dangle the financial advantages of doing it. Also, it's a good way for them to address lots of items of deferred maintenance that you have to go begging to the legislature to get some pieces of equipment placed, but if you can get them done through an EPC it's much, much easier.

Maria Vargas: Interesting. Okay, really quickly because we have two more minutes. Michelle, can you do this really fast? I feel like this person asked early and I want to make sure.

Dearborn, that's you guys, can you confirm that the snow melter for heat rejection, the lower load on the cooling tower, even when there is no snow to melt, a very shallow ground heat sink?

Michelle Croal: Yes. That's essentially what it is, yep, and we're planning to use it year round, even when there's no snow.

Maria Vargas: Okay, well done. I'm nervous that if we go to another questions, being that it's 1:43, that we will run over our time. So I think we're going to call it there.

Thank you all for being here, attendees and panelists. We really, really appreciate it. Michelle, Jim, Jeff, and David, we really, really do appreciate it, not only for today, but for stepping up and helping us try and be creative during a pandemic, how we were able to continue our desire to shine a light on the work that you're doing and share it with people, and sharing your expertise and your learning, and even sometimes the things that didn't work – although I didn't hear many of those today.

So kudos to all of you, but really, thank you for sharing the work that you're doing and continuing to share what you're doing, and your expertise and thought leadership, and not only what you're thinking about, but what you're doing at your facilities.

So thank you to everybody today. Thank you again to Ford, Iron Mountain, and the state of Maryland for hosting Virtual Site Tours and doing it twice, earlier in the year and then bringing those virtual tours to the summit. We all really appreciate it.

With that, thanks, everyone. We appreciate it. I hope you enjoy the rest of the summit sessions today. Thanks. Bye-bye.

David St. Jean: Thank you.

Michelle Croal: Thanks for having us.

Maria Vargas: You bet.

[End of Audio]