

Eliot Crowe:

Well, let's get started. Hello everyone, and welcome to the 2023-24 Better Buildings Webinar series dedicated to bringing you the latest actionable insights from leading industry experts. This annual series is a chance to explore the topics, technologies and trends that affect your organization as well as efforts to accelerate decarbonization and energy efficiency adoption. Next slide please.

Today's webinar is "Turning Insights into Action Bridging Building Data Analytics and Work Order Systems." Before we dive in, there are a few housekeeping points I would like to cover. Firstly please note today's webinar will be recorded and archived on the Better Buildings Solutions Center. We will follow up when today's recording and slides are made available for you to download.

Secondly, attendees are in listen only mode, meaning your microphones are muted. If you experience any audio or visual issues throughout the webinar, please send a message in the Q&A box located at the bottom of your Zoom panel. Next slide.

My name is Eliot Crow. I'm your moderator today. I work at Lawrence Berkeley National Laboratory as a Technology Researcher around building data analytics. Very happy to be here. Next slide.

So we're going to start out with brief introductions. We'll have the welcome poll. We have two great presentations lined up today, and we're going to do our best to make sure we have plenty of time for your questions, which we're happy to receive at any point throughout this webinar. Next slide please.

Now, let's start with some, oh, I think there was a poll that we were going to put in here. Was that right? Let's see. I'll keep rolling. Okay, that's later. Apologies for that.

So we're going to start with some grounding definitions for the building data analytics tools that we call Energy Management and Information Systems or EMIS. On the far left of this graphic here you'll see the range of data inputs that can be used through these building data analytics tools. So you do not need to use all of them for any single application.

Now, any given software tool can incorporate multiple capabilities and monthly data analytics is the first of those highlighted on this slide. Pulling energy and cost data for monthly bills helps with benchmarking, prioritizing efforts on the energy hubs in your

portfolio. It can also help you track progress toward long term energy reduction goals.

It's not too glamorous in terms of analytics, but it can be a big step, and it's surprisingly common that building technicians and building operators tasked with making buildings run efficiently never see the actual energy consumption and costs for those buildings. So it can be pretty significant organizationally.

We'll go with the next slide here. We then look at energy information systems, or EIS. That takes that energy data analysis to the next level. So using interval meters, you can get consumption values at hourly or even finer resolution. And with monthly data you can see how much energy you're consuming. With an EIS, you can see when you're using that data.

So on the right of this slide, we have some examples. At the top, a heat map chart can flag hot spots of energy use which may occur at startup, evenings, weekends. They're really good for highlighting when consumption trends change. For example, if someone overrides a lighting schedule you might see that on such a chart.

In the middle on the right, there's an example of load shape analysis. How does energy use change between occupied and unoccupied periods or between seasons. You can answer some of these questions with this kind of chart.

The bottom chart on the right shows load profiles in a calendar format. And this can be really useful for showing changes in consumption patterns when you switch for example from heating season to cooling season. Now aside from flagging trends and potential issues, an EIS can also be useful for ongoing monitoring of energy savings to help justify some of the investments you're making. Next slide please.

Next up, the main subject of today's webinar is really circled around FDD, fault detection and diagnostics. And these are tools that provide more actionable information compared to EIS, using data from your building automation systems. Applying more sophisticated algorithms, they can point you to specific operational problems.

So any building automation system will have a set of alarms, for instance to tell you that supply air temperature's out of spec. An FTD tool goes further by analyzing multiple points in the system. For example, analyzing outside air, return air, and supply air, you

can highlight some operational issues even though no single data point is outside of its specified range. FDD can also report on exactly when those fault conditions occurred, so you can look at some of those patterns too.

Beyond giving you a list of faults, you also have some excellent visualization tools to help you really drill down on the root cause of these faults. So for example, an FDD tool might tell you a specific sensor is giving a continuous flat reading, and you can go directly to look at trend data for that component in the same platform. Next slide please.

Finally, automated system optimization tools or ASO. These tools have two-way communication with the building automation system, and can continuously adjust HVAC control parameters to optimize performance. In some cases optimum might mean lowest energy consumption. In others it may be driven by minimizing peak time costs. ASO tools are not so common as EIS and FDD, but they've been around a long time and may be becoming more common as dynamic grid flexibility becomes important. Next slide please.

So here we see a view of how to integrate EMIS into your facility management processes. This is essentially monitoring based commissioning. Hopefully this graphic here is self-explanatory, but I'll just call out one key piece on the right of this slide: the fact that you need a human in this loop to review the analytics, do some additional diagnostics, prioritize and get the problems fixed. Our speakers today will be diving deeper on effective ways and tools for doing this. Next slide please.

So we've collected a lot of data on EMIS cost and benefits, and we'll touch on that briefly here. For EIS, we found median costs of two cents per square foot, median savings around 3% of whole building use. For FDD, the costs are a little bit higher, eight cents. But the savings are also higher, 9%. Meaning that in both cases you get investment payback around about two years. The link on the bottom of this slide gives you a location to look deeper into some of this data, some of these numbers that we've collected over the past five to eight years. Next slide please.

Now for anyone who is not already signed up, please reach out to us and ask to be part of DOE's EMIS Technology Research Team. This is a great way to stay informed on the state of the art and best practices around these kind of technologies. We meet three or four times a year and love to connect with technology team members on

some of our research work. Next slide please.

And finally, a quick word on some of the technical assistance and recognition opportunities available through DOE's campaigns. We'll share some links to these efforts in the chat, and whether you're looking to get recognized for great work that you're already doing or to get technical assistance to help you get to the next level, campaigns are here to help you. And we're very happy to talk to you about any of these that are managed not just by Berkeley Lab where I'm employed, but other national labs as well. Next slide please.

Okay, so today we're going to be using an interactive platform for Q&A and polling. Please go to [slido.com](https://www.slido.com) on your mobile device or opening a new window on your Internet browser. Today's event code is #DOE. Now, if you'd like to ask our panelists questions, please submit them any time throughout the presentation using Slido, and we'll be answering those questions toward the end of the webinar.

And if you look at the list of questions in Slido, you can give a thumbs up to the questions that you like the most, so they rise to the top of the list. And we'll make sure those are the ones that get asked. Next slide.

So we want to learn a bit more about you. So let's start off with a poll here. Please join us over at Slido to respond to the following questions. If you're having any issues, please message our tech support team by using the Zoom Q&A function.

Let's see who we've got. A lot of contractors and consultants. Come on higher ed, you can catch up. Local government, this is good. 12% in the other categories. Okay. A lot of higher ed, good to see that. We've had a lot of past interaction at Berkeley Lab with higher ed. They've taken a really strong lead in a lot of these analytics. And that's a great match, with Scott Sellner being here from University of Iowa today.

Okay. Let's keep things moving. Thanks for responding there. Great to know who's in the audience here. We have a great lineup of presenters today. First, we have Scott Sellner of the University of Iowa. He is a Controls Analytical Specialist, and he's been in the building automation field for over 30 years, installing, programming and maintaining various systems, with 20 of those years being in higher education.

Second speaker today will be Gary Mullaney. Gary's a senior energy and water consultant with Kaiser Permanente, an integrated healthcare system, where he supports affordability and environmental stewardship goals. Thank you both for being with us today. And with that, I will hand it off to Scott to kick off this presentation.

Scott Sellner:

Hello. Yeah, I'm Scott with the University of Iowa, and I'm just going to briefly go through our workflow and how we turn faults into action items, and complete those tasks. Next slide please. And the next slide.

So, this is our group. How we're set up at the University of Iowa. So we have two analytical response specialists. These two people are very experienced HVAC technicians. Many, many years in the business. These two individuals deal with the fault detection and diagnostics tool on a daily basis. And either divvy up, hand out the work to others within the University of Iowa, or take care of those issues themselves.

We have a controls support person, that's myself. I can handle some of those issues. If it's beyond what I can handle I turn it over to a team of control people who are control specialists that are, many of them are much more experienced than I am. So we can turn the work over to them, and they can get the work done if it's more involved programming issues in the BAS system.

We have two engineers, a mechanical and electrical engineer. We can go to them for support if we need baselining or cost put to projects. And then we have our priority planning. That's our area maintenance people. So that's a big group there. Our university is divided up into different subgroups, and we can hand the work off to them and get the actual work completed.

Another member is our fault detection and diagnostics software. We have a provider. We have a support person with them. We meet with them every other week, and if we have problems with faults that we need to have modified or anything to do with the FDD software, then they provide the help to us. Next slide.

So I'm just going to show you here how we turn a fault into a work order, and we'll get into a little more detail in the next slides. So this one here, our two analytical response specialists start working left to right. We'll take a look at a fault. And anything they act on, they need to turn it into a work order in our CMMS.

So, we have a seamless integration with FDD and our CMMS. They can simply create a task, and that task then, it's generated into a work order. So, we push that information over to our CMMS. CMMS generates the work order. And then that CMMS pushes that information back to FDD software, and we can create the work order.

And from there, we can divvy up the work, whether it's our analytical response specialists or our area maintenance people. Then have a work order that they can act on with the information already in the work order. So we'll just demonstrate how we deal with a typical work order, from a fault to a work order. So next slide.

So this is kind of how we take a fault and decide how we act on it. So at first, our analytical response specialists take that fault and they kind of look at it, and dive into it and find out, is this a valid analytic? And you can kind of, I won't go through every box here. But basically it's our workflow to decide if it's actionable or if it needs to go back to our FDD provider.

And some of these faults are faults because they might not be set up correctly. And so that's how we deal with whether it's an actionable work order or it's a behind the scenes issue with the fault. And so as you can see, we, if it's a fault, we push it to the right. And then the work order gets acted on upon our maintenance staff. And then we have a close out.

So once the work's performed, we always make sure the fault's cleared before we actually close anything out. Or, if we find out that the staff doesn't find any problems and it's still an issue with our fault, we have a way to get it back to our provider and work with it from there. Next slide please.

So this is what we see on a day to day basis, right? So this is an example of a fault that we had this spring when we were filling chill water coils. We had a fault for a leaking, we had a rise across the cooling coil and, or a drop, excuse me. So what we found is in this particular situation we had a leaky chill water valve when we filled the coils. So our analytical response specialist went out, verified the valve was leaking. And we turned that into a work order. So next slide.

So from here, this is in our FDD software. It can click create a task, and then it auto populates certain fields. We then assign it to somebody. We can add notes to it. And then we have a box that we

check that we want to turn that into a work order within our CMMS. So we click that. We populate everything that we deem necessary. Next slide.

And so now, this seamlessly went out, got a work order number assigned to it in our CMMS. That gets populated back in FDD. And then the screenshot below there is what our CMMS software looks like. So there's the work order. You can see the notes are brought in from FDD. And then our maintenance supervisor assigns the work to the technician that they want to go out and perform the work. So the work's performed. Next slide please.

The work is performed. The valve was replaced. That's shown in the top. That's in our CMMS software. Then like I said earlier, we don't close any faults out until we know they've cleared. So we looked at some history on that particular piece of equipment. The coil's not showing any faults. Everything's working fine. And then we close out the work order in CMMS and we close out the task in FDD. Next slide please.

So this is a little snapshot of what we've got going currently and where we've been since we started with FDD. So on the left is kind of what we have going right now. Current tasks that we've identified and that we're in the process of taking care of, fixing. And then the table on the right is all the tasks that we've completed. And all this information is provided by our fault detection and diagnostic software. It calculates all that for us. Next slide please.

So where are we going next? Well, our fault detection diagnostic software, we're working on a new interface. And so with that we're going to work on our workflow with our CMMS. It works great now, but we've got some room for improvement, and that's what we're working on. We're also looking at using FDD and condition-based maintenance.

We would, we're not very good at Iowa, getting FDD installed in new construction projects or for commissioning, so we want to improve on that. Getting more frontline staff involved, and that just kind of comes with time. And as people learn to accept FDD, we can get more people excited to get involved with it. And so that's what we're working towards.

We have EnergyCap that takes our pie data, our utility data. We're working on some more integration with that. And we're also rolling out a new total cost of ownership program at the University

of Iowa, and we want to use FDD in determining the life cycle and costs associated with those particular assets that are connected. And with that, that's pretty much all I have.

Eliot Crowe: Thanks so much, Scott. I'm going to throw a couple very quick fire questions at you from the chat here. So how many facilities do you manage, what's the overall square foot, is the first quick fire question.

Scott Sellner: Square footage, we're at about 5.8 million square feet that's connected to FDD. And I'm sorry, what was the other question you had?

Eliot Crowe: And how many buildings, facilities is that?

Scott Sellner: About 48. 46, excuse me.

Eliot Crowe: Okay, great. Thanks. And what kind of controls do you have, is a quick question.

Scott Sellner: Yep. We have Johnson Controls Metasys, and we also have Schneider Electric Continuum that we're phasing out and rolling into the new ecostructure.

Eliot Crowe: Great. Thanks for that, Scott. We have some other great questions coming in. I won't interrupt the flow here right now. We've got those for after. And for anyone in the audience, keep those questions coming as I hand over to Gary. Take it away, Gary.

Gary Mullaney: All right. Good morning, good afternoon everyone. Next slide. Next slide. So today I'm going to give you a quick overview, just so you have a sense of the background of what our program looks like. Then I'll talk about, I want to focus on why we're doing this, because that's really important. And then I'll talk about the integration itself. It's not that different from what Scott's got at University of Iowa.

So I'll be a little bit less on that and then I'll talk a little bit about our desired outcomes, what are we trying to get out of this. And finally, I'll try to spend the bulk of the time talking about what are our lessons learned, because I know that's what a lot of folks want to know. Next slide.

So for an overview, this is a snapshot of our overview of our FDD deployment. To give you a little bit of the background, we started with an RFP. So in 2014, there's an MSA eventually piloted

through 2016. Then I came on board around 2017. At that point we really were starting to scale the program, and that's what we've been doing since.

So our goal is to get RFDD and get implementation in all 40 hospitals we manage as well as many of our 700 plus medical office buildings. So all the ones that, the target is all of our campuses that have at least 100,000 square feet. But we're already going smaller than that. But that's at least a minimum, is to get those larger campuses. That's where we're going to get the base benefit.

As you can see from the map, very different from the University of Iowa. We've got a lot of square footage, but ours is much more distributed, which has its own challenges. So with that, you can think of this as every deployment. It's almost, it's our own, its own team. It's its own implementation. So it's really, instead of managing one big implementation of monitor based commissioning and FDD, it's managing this dozens of them across the country.

So makes it fun. Definitely keeps me busy. Our focus right now is really on adoption, and that's where the integration comes in. Because I think that's going to be critical to driving adoption, which as was mentioned at the beginning, these are powerful tools. There's lots of tools out there. But if no one uses them then you're not going to get the value. So you've got to make sure, adoptions really going to be one of the main focuses once you've got deployment in place. Next slide.

All right, so this is just at a high level, what the process looks like. And so I want to get into sort of why are we focused on integration. So one of the pieces is if anyone's ever read the book *Switch*, they talk about sort of you've got to motivate the elephant. You've got to instruct the rider. And then you've got to make the path easy and smooth.

So this is focused on making the path easier. So as part of change management, you're trying to bring in a new technology and you're trying to get people to change their behavior. So the easier and smoother you can make the path, the better. So the first thing we did was, because step one in all of this is, you've got to log into the software.

So we worked out, we did a single sign on implementation this year that makes login a lot simpler. So it's easier, just removes one

barrier to getting in. So especially for those folks that aren't using it as often. Even the folks that use it more often, if it's one, if it's two clicks versus needing to go through and log in, it can just make it that much easier to get into the system is step one.

Then as they go through, I like to think the left of the slide here is sort of the triage step. Getting in there, reviewing the analytics, deciding if it's valid. Just like, very similar to what Scott's team does. They just do it in a more centralized way because of the way the campus is set up.

Ours, it's, we usually have a handful of champions at each site that are focused on this triage step of reviewing the diagnostic. And you see the big part is right now, without integration there's this sort of dual path. You've got to use your FDD tool, if it has one, to track the task within that tool. But then if you really realistically want to get it done, everyone's got a CMMS tool. You've got to also track in your CMMS tool.

So that creates this redundant work, which honestly either slows it down because you've got to do it twice, or it just doesn't happen. Which I find the latter is what happens a lot. The teams that are successful do it, but it is definitely a pain point and slows down the process. So that's why we really wanted to target. We can make that integration one extra click. That's going to really smooth out the process. Next slide.

The second reason why we're doing this is, it's part of a broader push to shift our focus when this tool and this program really started. When I came in it was, the focus was really around energy usage and spend. Carbon reduction. It was very much seen as this energy tool. Powerful tool.

And the more I spent, the more time I spent managing the program and learning about it, the more I saw that we had struggles. You're going to have the teams that really get it and understand the use, and they're going to adopt it. But a lot of teams, that's just not their primary focus. Operations and maintenance is their bread and butter. That's what they do day in and day out.

So what I want to do is, we're trying to shift the focus from seeing this as an energy management tool to more seeing it as an operations and maintenance tool with energy benefits. So that's, this is going to help make that shift, because our CMMS is their primary tool. That's what they're in day in and day out. So, if you can have things integrated, you're going to get a lot of value out of

it. It's going to help that shift. Next slide please.

All right, so talking about our actual integration. We do a task level integration, so there is a human in the loop. Not every single fault that is identified by our FDD gets raised, gets created into a work order. There is a human in there validating them, making sure we're picking the things that are actionable, and then raising those to tasks. And then with one extra click, then it can get pushed over into our CMMS.

So the actual technical integration piece is there's an API from Nuvolo, which is our CMMS. And Nuvolo's built on top of the Service Now platform. So that's our CMMS. That call does the API call over to Clockworks Analytics, which is our FDD tool. New tasks get flagged within Clockworks, so within the FDD tool we'll flag them.

And that's what's going to get called in the API. Every hour they'll pull any new tasks that have been created, and create a new work order. Updates go the other direction, so once that work order goes through the system it gets assigned. It gets updated in Nuvolo. So they've either completed it or they've started working on it.

Those updates will then flow back to Clockworks so that both systems can be tracking the right information. And that's done on an on demand basis. This sort of key piece to this, there's what I call the technical integration which is what I just talked about. That in order for this to work, you have to map the equipment between the two systems. And I'm pretty sure that this probably applies to everybody.

And you think of it as this is so that the two systems can speak the same language. And so that's really, I'll talk more about it. But that's really the long pole in the tent in this whole process, to a wide scale deployment. Especially if you're further along in the process. Next slide, please.

So our desired outcomes. So what we're trying to get out of this if really trying to improve adoption, like I said. So one of the things is bringing the full engineering team into the process. When you don't have, when everyone has to go into this new tool, review this stuff and get the, take action, it's a lot harder to get people to use a new tool.

But if we can get that tool and integrate it with the tool that everybody's already using, so our CMMS is already what folks are

using day in, day out, we can get that small subgroup to get into the FDD tool. Use that and then push the work that needs to get done into, and then you can really unlock the use of the whole team.

Because what I have found, especially with a distributed deployment and a distributed adoption like we have, a lot of it tends to get put on that one champion. And they end up having to do the entire process, and you really just can't get as much value out of it. And that person can get very easily kind of worn down and overwhelmed with all the work. But if it can, if we can really make this a team sport, a team approach, it's going to help things out a lot.

Improves leadership visibility, because right now our FDD, our program, as much as I try to bring it in to leadership. It does get leadership visibility, but they're not looking at, those are an extra set of metrics. They already look at game completion, right? They look at corrective maintenance. So if we can have this integrated with things they're already looking at, it's going to give more visibility and really help drive that adoption.

It also demonstrates an organizational commitment. Any time you're trying to do change, you need to show that a lot of people can be slow to adopt change, because they think it maybe is just a fad. It's going to come and go with, when leadership changes out.

But if you can really show that there's a commitment and investment, that the organization is investing, I think that can really help people take this seriously. Just know that it's not going away. This is sort of inevitable, and they kind of, they come along and they're a little bit more receptive.

Finally, like I said, this enables that shift from being energy centric to being more facility operations and maintenance focused. And like Scott, we're trying to move towards condition based maintenance. We've got some pilots in there, improving environment of care.

There's a lot of these additional, we used to think of it as energy with these co-benefits of maintenance and comfort. I want to change that, sort of put it on its head and have the focus be maintenance and operations with energy being one of those benefits. Next slide.

So, the status of the technical integration is in production. We have

one site that has actually done some of the mapping. And so they're up and running, but it's very limited. Even at that one site, it's not all of the equipment. So the real focus right now is on that what we call our EIN. It's equipment identification numbering. Getting those mapped between the two systems.

So there's a lot of that nuance that goes into that. You've got to make sure that what equipment actually needs to be mapped. Is it all of it? In some cases we have to create new assets in our CMMS that didn't, we didn't have and track as assets before. For example, like all our zone units, we didn't track those in most cases in our CMMS. Well, now we're going to have to create those in there so we can get that level of fidelity.

And so as part of that we've got a pilot site up and running. We've got some early adopter sites that are working on implementing a playbook we created. We drafted a playbook, which really gives the step by step how to do this. And then we're, the goal is to start doing more the enterprise rollout in 2024.

So we'll have the playbook for self-service. We also are working on a larger ongoing sort of asset alignment process and this will happen as part of that asset alignment with the teams that want to jump in earlier. They can do it on a self-service basis. Next slide please.

All right, and finally to the part I think most people probably care the most about. What did we learn through this process? So to reiterate, engagement is critical to adoption and value creation. So powerful tools don't mean much unless someone picks them up and uses them.

So it's all about driving engagement. In order to drive engagement we're trying to make the path easier. So that's where the integration comes. It must be a team sport. Like I said, if you try and put it on one person, it's, even if you've, I've had teams that have been, I've had sites that have been wildly successful with that one person. And then that one person changes jobs or leaves, and you're back at square one. You get the value but you've lost that adoption and you can slowly start backsliding.

So really wanting to build it into our processes, build it into the way the team operates. And I think that's where getting things aligned to ONM and seeing the value from an ONM standpoint and not from an energy standpoint's going to be really helpful.

I'd say for the integration specifically, start early. If you are in the early process and you do an RFP, I would think about it. Maybe you don't pilot. Maybe you don't use it in your pilot. But as soon as that pilot is successful and you've got organizational buy in that you want to do this, I would spend the money to do that. Start doing that integration. Because it's going to make your adoption a lot easier. And it's going to set you up for success later.

It will also make it easier if you're doing this along the way versus not. But we're in, we've got thousands of pieces of equipment that are going to have to get mapped. And so it's going to be a bit more of a task over the next year to do that work. If you were doing that along the way it wouldn't have been so bad.

Get buy in from whoever manages the enterprise maintenance management system. Make sure they're bought in and they understand what you're trying to accomplish early so you're not, and that was one of the reasons we've been really successful. We had I think at the senior leadership levels within the organization a real buy in to what we're trying to do. A real buy in to what we're doing.

So they made sure when we rolled out our new CMMS in the last few years, they made sure that this was part of the integration plan. It wasn't the first thing that got integrated, but it was written into the plan so that it happened. I didn't have to go back later and fight to get it added. It had it already in there, so.

And you can work through the nuances of the difference between what's in your CMMS and what's in your, that's going to be something you need to think through before you start doing your mapping so that you can give people clear guidance, so. That's my last point I think.

Eliot Crowe:

Thanks so much, Gary. And also to you, Scott. Before we transition to Q&A, I just want to encourage all the attendees here to download our additional resources handout. You'll find this in the Zoom chat box, to download that. And this handout contains links to resources from Better Buildings, and our speakers on today's topic. We hope you find that useful.

We are now going to move on to Q&A. If you haven't already, please take a look at Slido with this hashtag here. We do have some questions coming in already. I'm really happy we have about at least 15 minutes here to get through some of these questions.

So I'm going to start from the tops. This one got three thumbs up, and just a reminder to all attendees, you can give a thumbs up to the questions you vote for to be asked. So first question, I'll ask this let's say first to Scott. So does FDD enable you to run your operations with a smaller team? Or are you just making buildings run better with the same size of team? Or something else?

Scott Sellner: I would say in the case of Iowa it's the latter. Yeah, we did not increase staff at all. We redistributed some staff, and yeah. We're making it run better with the same size team. Our focus is to be on, to be proactive on our maintenance. And this tool definitely helps us do that.

Eliot Crowe: Thanks, Scott. Same for you, Gary?

Gary Mullaney: Yeah, I'd say the same. I think that first question's always interesting. We definitely have not, our staff has gotten smaller. But it's not as a result of this. We've been trying to use the FDD to help make our team work smarter, not just harder.

And so, some early signs of some of our condition based maintenance is that we really could get some time savings from that. I don't think you're going to just from the, you're not going to get it from the energy stuff. Because that's really going to likely be seen as extra work.

But if you can start getting into the maintenance and start doing condition based maintenance you can get some real time savings. But our goal is not about shrinking our team. Our goal is running our buildings better. There's always work to do that's not getting done.

Eliot Crowe: Great. Thank you. Thank you both. And Gary, we'll stick with you for the next question here. We're always really conscious of not wanting to explicitly or implicitly endorse products. But the question always comes up. Can you just speak a little bit to your process and how you selected your FDD tool, and make a quick mention of what tool that is?

Gary Mullaney: Yeah. So I was not there when we did the original RFP, so I was not intimately involved. But we followed the typical early RFP process. We went out to the market with our requirements and then we, I think we gave them some initial data for them to actually test it out. So we let them show us what they could do.

And this was back in 2014, so the markets changed pretty

significantly since then. But there were a lot of different players. And from my understanding, kind of holistically is where we picked Clockworks, and so we've continued to use them since.

Eliot Crowe: Thanks, Gary. Same for you, Scott?

Scott Sellner: Yeah. We went through an RFP process as well and selected Building Advisor through Schneider Electric, which is a Clockworks rebranded product. The same product. And we have AssetWorks for our CMMS software.

Eliot Crowe: Thank you. All right, and I'm just going to go straight to the next question here. It's got three thumbs up as well. So if FDD indicates a problem but then you find it's not an issue, how do you then eliminate that in future without disabling points that might mean you missed some real problems? Scott, you go first on this one.

Scott Sellner: Yeah, we can modify the faults at a building level, per equipment or across the portfolio. So if we, and no two buildings are the same, right? So we can tweak those faults on an individual basis by a particular piece of equipment to eliminate the flags that are not real issues.

Eliot Crowe: Gary?

Gary Mullaney: Yes, I'll just say that this can be a challenge. It's definitely something to think about. It should be a dialogue back and forth. We focus on trying to get the folks that are really well versed in the tool, in the FDD tool and their BMS to do that and try to, and our vendor does a decent job of pushing back if something doesn't quite make sense.

Because quite often what will happen when you first deploy an FDD tool is they'll say oh, that's not an issue. And it might just be that they don't fully understand what the tool is trying to tell them. Or it might just be a gap on their side. So it needs to be handled delicately. I would try to make sure you've got somebody who is bought in and understands what's going on first, to try to screen things out so you can really clean up as many of your faults as possible, so you don't have those false positives.

Then really, you can kind of try to spoon-feed some faults to your folks. I know Scott's team, I've heard him talk about. They really put their, the faults through the ringer before they let anyone see them, so that they're, the technicians aren't getting any false positives. We could probably do a better job with that. But that's a

big push. Because otherwise people lose faith in the faults early on, and that sort of undermines your effort.

Eliot Crowe:

Yeah, that makes sense. I keep having all these follow-up questions in my mind, but I'm going to let other people's questions take precedence here. It's good for the next question here, this is about what kind of resistance you've faced from all directions. So management above, funding support for the organizational changes, and also from technicians using the tools. What kind of things have you faced there? Gary, we'll go with you first here.

Gary Mullaney:

Yeah, so ours is so varied, because it's so distributed. I find that we get less pushback from management than we do technicians. Mostly because I think management can get it. But they're also not the ones who are going to have to do a lot of the changing. It's not changing their, the way they operate day to day. So a lot of times they will sign up for it.

So what I push is when we talk to them, make sure you don't just get the facility director bought in, but we really get the chief engineer or the assistant chief, get those folks in the room so that they're bought in as well. Because if they're not bought in, your adoption's going to really, you're just not going to be successful.

And so the pushback I get from management might be around costs. That doesn't happen that often. The cost is fairly reasonable in the grand scheme of things, especially when they consider their utility budget. And then, or we've been able to get a lot of ours deployed through capital projects, so that defers that higher first cost. And then the additional service cost is pretty reasonable.

So that hasn't been an issue. Sometimes management will push back if they don't think their team is ready. Which, if they push back for that reason, then that's perfectly fine by me. Because their team needs to be ready for this. We don't want to deploy it without their team being ready to use it.

And then on the technician side, it's stuff like the faults. They don't, some of them, sometimes the folks that are really good at their BMS think that they don't need anything else. So those are the folks that can be challenging. But usually it's a matter of the resistance is just, you're asking the extra work with the CMMS integration. I think it's going to help alleviate some of that, and it's just, we don't have time for it.

And a lot of times it just comes down to prioritization. So getting

the leadership thought to make this, help them understand where this fits within their set of priorities and not see it as a separate energy added work.

Eliot Crowe: Thank you. Thanks for that. Scott, same question.

Scott Sellner: Yeah. We were lucky at Iowa. Our management was very proactive for FDD. They're the ones that pushed it. So, that wasn't an issue for us. The resistance, we have had some at the technician level, because there's kind of at times, they think we're finding, we're creating problems. But we're just helping them find the problems before they become a bigger issue. And that's changing now, right? So I think we're getting more acceptance by our building technicians now. It's just become a new way of doing work.

Eliot Crowe: I'll maybe just extend that question here a little bit. Gary, you mentioned about the whole risk of if the champion leaves, you want to make sure the whole program doesn't sort of collapse in terms of having that continuity. Presumably you've both been involved in having to hire new people and add to the team when there's turnover in staff, et cetera.

Are you finding that there are people out there with the skills you need to just drop in and start using these kind of tools? Or are you doing a lot of the training yourself in FDD or the CMMS once you've hired people? Maybe Gary, you can go first on that.

Gary Mullaney: I will say training and the knowledge, kind of knowledge, skills and abilities of our engineers, is one of our limiting factors and a challenge we have had. Scott and I mentioned some of the realignment of the team, and that is something we've tried to do. We don't have the centralized team that Scott has in Iowa. Ours is all decentralized, so it makes it harder to have specialized teams when your teams are smaller.

But some of our regions have started, have seen the need for that BMS/energy/analytics sort of guru, and they've created a regional role for that. And that they can help really drive the change and drive the use. And they've got the skill sets. And then they can start, they do a little bit of spoon-feeding. But they can start training the engineers on it.

And quite often, not all of the faults are terribly complicated. It's sort of, sometimes it might be a matter of all right, some of it's really programming base, and those you need to filter to the right

people. But then a lot of the things are more mechanical, aren't as complicated. And so if you can push those out to the team, even if you don't have a strong BMS background you can still handle those. So it's a little bit of triaging the faults and getting to the right people. But yeah, you definitely, the training has been a bit of a challenge in some regions.

Eliot Crowe: Thanks, Gary. And Scott, same thing. Just a question on recruiting the skills you need and training, et cetera, generally.

Scott Sellner: Yeah, recruiting's always an issue. But as far as the training goes, from the fault detection software it's for our product, it's got a lot of plain English results in the faults. And it really kind of points you to where you need to be looking, so that definitely helps.

And from what I've seen with the newer, younger workforce, or the people coming there, you know, they're more technical than I was, you know, probably 25 years ago, right? So they're more savvy on their phone and their iPads, and software is, comes natural to them. So I think the training is easier probably when we get somebody on board, if that makes any sense.

Eliot Crowe: Yeah. Like getting that momentum, critical mass, going. Thank you. All right, so we've got maybe another five, six minutes here. Let's get to the next one here. This could be a tricky one. Iowa's annual budget for FDD and CMMS. I will ask this to you as well, Gary. But anything you can speak to around how you budget, if it's per square foot, anything broadly that you can share around the budget side of things. Scott first.

Scott Sellner: I guess I don't have the exact numbers. Our integration with our CMMS, that cost there I don't think has increased at all when we brought on FDD. There was some back, some behind the scenes work that needed to be done, that we've paid for. As far as the actual cost for FDD, I don't have that number in front of me. But in showing, in those numbers that I had in my slide presentation, it's definitely paid for itself in the savings over time. So from that standpoint, it's paid for itself.

Eliot Crowe: Thanks, Scott. And then Gary, you kind of mentioned this sort of somewhat previously around how it's relatively low. But anything you want to add to that?

Gary Mullaney: Yeah, I can't speak to the CMMS software. I'm not really involved in that. That's adjacent to my work. On the FDD side, I have zero budget. So everything we do is through our local teams. So it's

either through our capital projects teams, we'll do a lot of deployment for the, that's a requirement on ours that for any new construction or if you're doing HVAC work, if you're going to do any more than 250,000 in controlled spend, you're required to include our FDD solution to make sure we make the most of that.

So on a capital it's a drop in the bucket. It's like a rounding error in a capital budget. So I've gotten really no pushback on that. At least once they've heard the numbers, they never push back. Before they have numbers they're like hey, that's some additional cost. But once they see the numbers, they don't really push back on it. And then yeah, the operating cost is pretty reasonable, especially when you look at, like I've looked at how much has been, like I'll look at all the faults and what's being identified by the FDD.

And then I'll normalize that to square footage, and it's always significantly more than what we're paying. And considering that it's not just we're getting the faults, but we're obviously getting the service and support from the team, yeah. I think it's a pretty good deal.

Eliot Crowe:

Nice. Thank you. And it looks like we've got three questions lined up here that all kind of circle around the same topic. So I will stick with you, Gary, since you're talking anyway. So how many faults typically get reported? What are the most common types of faults? And do you find that over time that's a reducing number or just a changing of the types of faults that are looked at. So we'll see if we can cover all three of those in a combo answer.

Gary Mullaney:

Let's see. I would go back to my original slide I had, was it 4.6 million diagnostics were run? It shows what the amount of fault, it's a lot. I try not to think about the volume, because sometimes that overwhelms people. I tell them the tool's really good at prioritizing, so don't focus on trying, like you're not trying to get to zero necessarily. Just use it to prioritize what's most important.

Some of that stuff can, because when you think about if there's a fault on a zone, think about how many VAVs and how many boxes do you have? It can multiply pretty quickly. But if you prioritize, you can really get down to a smaller subset. The teams that are really well engaged, you will see a real reduction in the number of faults, the fault prevalence. And we also look at the fault priority as well.

So each one of these faults are given a score from zero to ten. And then same thing for any fault that has energy and they can calculate

it, they'll give it the avoided costs. And so we've got quite a few sites that have no, they're showing no avoided cost anymore, because they've eliminated all the energy stuff.

They might still have some comfort and maintenance items that they need to address, but. In that case it's not trying to get to zero, it's just trying to eliminate the kinds of faults. It's all the same stuff I think I've seen on some of your slides, Eliot, that you've shown, so it's simultaneous heating cooling. It's leaking valves. Yeah, so valve issues, sensor issues.

We actually have a clean bill of health that we do for new buildings. So for those it's, they should eliminate all the valve issues, all the sensor issues. Cycling is another pretty common one that's a maintenance issue. And for energy, a lot of that is on the programming side. It's a matter of like, there could be, you could have an optimized program, or it's overrides, or it's, Scott could probably get into more details. We use the same tools, so I know he's closer to the technical aspect of it.

Eliot Crowe: Thanks, Gary. And Scott, let's just round things out. If you want to respond to that question, then I'll close out the proceedings here.

Scott Sellner: Yeah, very similar to what Gary said. I guess I would probably, we're running around 13,000 analytics that are run per day just in our portfolio about 4000 actual results. And like Gary said, we're never going to get to zero, right? But what's nice is we can use the tool for, as we go through change of seasons we'll look for different things now, as we're transitioning to heating we'll look for other faults for that or they'll come to the top. And likewise when we go to cooling. So yeah. About the same as Gary.

Eliot Crowe: Great. Thank you so much. You know, you answered so quickly Scott, I'm going to throw one more in, because I see a popular question at the top there. I have to keep the answer somewhat brief, but does your FDD monitor energy directly? At what granularity does it flag? And what are the triggers for that? Scott, do you want to go first with a quick answer for that one?

Scott Sellner: Yes. So what our FDD does is it takes into consideration all the equipment that's connected. So if we're at a VAV level fault it takes into consideration the energy used at the air handler. And so it plugs in that, the water, horsepower, and all that. Our connected steam, our connected chill water costs. All those utilities are all used in the calculation for the fault.

Eliot Crowe: Okay, thanks. Gary?

Gary Mullaney: Yeah, so I think when it comes, like Scott said. So they call it virtual metering. If you can, so they can use the BMS and they can calculate points to do virtual metering. One of our challenges is we don't have much for metering pulled into our BMS and pulled into our FDD solutions.

So I think there is some more direct energy monitoring possible. We just haven't enabled that. It's actually something I'm looking at, because we have another EIS tool that has a lot of that. But it's not quite as mature, so if I can start kind of pulling those together into one platform, I think that's a direction we can get some additional value.

But right now, yeah. We, submetering and metering have just not historically have been pulled into our BMS. And thus far it's not easily accessible for our FDD solution.

Eliot Crowe: Thank you both very much. We'll move to the next slide here. Just a few closing announcements. The first one is just to thank all the attendees here for your questions, and obviously to our panelists Scott and Gary for their insightful responses.

This has been part of the 23-24 Better Buildings Webinar series. And as you'll see on this slide, we have a great lineup of presentations through March. And you can go to the Better Buildings Solution Center to find out more and to register for all of these.

If we go to the next slide, you'll see that next week at the same time we have a webinar on Cool Runnings: The Race to Phase Down Industrial Fluorinated Gas Emissions. Learn from leaders in Better Plants program, eliminating fluorinated gas emissions.

The next slide is about the Better Buildings Summit. We're very pleased to announce registration for next year's Better Buildings, Better Plants summit. This will be in Washington DC April 2 through 4. Lots of engaging interactive sessions, and also plenty of opportunities to network with your industry peers and experts. And you can explore the tracks if you go to the link on this slide here.

Next up, next slide here, check out season one of the Better Climate Challenge Road Show as our energy experts hit the road to see how partners in the Nashville area have been reducing their emissions, such as Nissan, Whirlpool, Chemours, and you'll be

able to see decarbonization in action.

As a reminder, the Better Climate Challenge is a program where partners are on their way to meeting their goal of reducing emissions by 50% in the next 10 years, and this road show's a great way to see how they're doing with that. Next slide please.

With that, I would like to thank our panelists, Gary and Scott, so much for taking the time to be with us here today and sharing their expertise. Please feel free to contact the presenters directly and reach out to me if you want to join the technology research team for this kind of analytics and be part of more of these kinds of conversations.

And look out for the Better Buildings Initiative at LinkedIn and Twitter for all the latest news. Now you will all be receiving an e-mail notice when today's recording, slides and transcript are available on the Better Buildings Solutions Center. And with that, I would like to thank you all. Have a good day.

[End of Audio]

Turning Insights into Action: Bridging Building Data Analytics and Work Order Systems

Additional Resources

Learn more about the topics discussed on the webinar by visiting the resources below.

Better Buildings Resources

- Energy Management Information Systems [Webpage](#)
- Smart Energy Analytics Campaign [Toolkit](#)
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Other Resources

- Learn more about the Lawrence Berkeley National Laboratory Building Efficiency Campaign [here](#)
- Learn about how Kaiser Permanente's Carbon Neutral Health System in the U.S. [here](#)
- Kaiser Permanente's Carbon Neutral [Roadmap](#)
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