

*Bruce Lung:* Hello and thank you for joining our webinar today. We're going to give folks just another minute to log in and then we'll be starting soon.

*[Break in conversation from 0:00:11 to 0:01:02]*

*Bruce Lung:* Well, we'll go ahead and get started. Thank you all for joining us today and welcome to the 2022-2023 Better Buildings webinar series. We are dedicated to bringing you the latest actionable insights from leading industry experts, partners, and others. This annual series is a chance to explore topics, technologies, and trends that will affect your organization as well as efforts to accelerate decarbonization and energy efficiency adoption.

So today's webinar is called "MEASURing Up: Leveraging the Capabilities of the MEASUR Tool Suite." Before we dive in, I'll just go over a couple housekeeping points. Today's webinar is being recorded and will be archived on the Better Buildings Solution Center. We will follow up when today's recording and slides are made available. Also, attendees are in listen only mode, so your microphones are muted. If you experience any audio or visual issues during the webinar, please send a message in the Q&A box located at the bottom of the Zoom panel.

My name is Bruce Lung, and I'm your moderator. I'm also known as Robert Lung, so don't feel bad if you call me Robert or Bruce. I respond to both. I've been supporting the Department of Energy's advanced manufacturing offices for about 22 years now, and I'm really happy to bring you this webinar on some important software platforms that are contained in the MEASUR tool suite.

Today we're going to go over basically an introduction. We're going to have a MEASUR overview from our lead developer at the Oak Ridge National Lab, and then we're going to go into some partner kind of testimonials about the experiences with the MEASUR tools and the value that they've gotten from them, and then we'll launch into some Q&A sessions at the end.

So today we will be using interactive platform for Q&A and polling called Slido. If you can please go to Slido.com on your mobile device or by opening a new window in your internet browser, today's event code is #DOE. DOE is all caps. If you would like to ask our panelists questions, please submit them anytime throughout the presentation in the Slido box. We will be answering your questions near the end of the webinar in the order they're received and by the amount of thumbs up they get. You can

select the thumbs up icon for questions that you like, and this will result in the more popular questions moving to the top of the queue, and those will be the ones we'll likely focus on.

So we want to learn more about you before we get started, so we're going to start with a few polls. If you could please join us in Slido and respond to the following questions, then if you have any issues, please message our tech support team by using the Zoom Q&A function. Have you ever used MEASUR? We'll go ahead and give folks a few more seconds here. We may have some new users today. Okay, great.

The next poll is what sections of MEASUR have you used for those of you who have used it? Pumping is jumping out to a lead here. Compressed air and steam is also pretty popular. Calculators, all right. We'll give folks a few more seconds. Keep on responding. It looks as though calculators and compressed air are kind of the lead platforms that are most popular here. Great.

Great, well thank you all very much. That's very helpful for us to know. I'll go ahead and start presenting or introducing our presenters today. Our first presenter is Miss Kristina Armstrong. Kristina works for the Oak Ridge National Laboratory with a focus on energy and technoeconomic analyses with various technology applications. She is the lead engineering support for the DOE's technology transition, our legacy software tools that were all done in the 1990s and early-2000s to a modern open source format called MEASUR, and she's also a technical account manager for the Better Plants program, assisting partners in achieving their energy use reduction goals and connecting them with the DOE resources to reach greater energy savings. I'll just note that MEASUR is our acronym at DOE that stands for Manufacturing Assessment Software for Utility Reduction. So, Kristina.

*Kristina Armstrong:* Hi, good morning. I guess let's just get started. First off, next slide please. So as Bruce said, MEASUR stands for the Manufacturing Energy Assessment Software for Utility Reduction, but it is just – it's MEASUR. It helps people in the industrial or commercial spaces model manufacturing energy use and generation. We have seven different assessment types: pumps, compressed air, fans, processed heating, steam, waste water, and what's called the treasure hunt. We have currently one inventory type for motors, just let you track what type of motors you have in your system, how many, where. And we have over 70 calculators as 30-some odd of you know, including for all the systems I named before plus more for motors, lighting, CHP, heat recovery, and so forth.

You can download MEASUR by going to the link shown above: [energy.gov/eere/amo/measur](http://energy.gov/eere/amo/measur). You can also use whatever search engine you are most comfortable with and just type DOE MEASUR and that should get you there. You can also visit [MEASUR.ORNL.gov](http://MEASUR.ORNL.gov) and that will get you an online version. We are still improving MEASUR. Updates occur about once a month. You will get an automatic notification for updates if you are connected to the internet. You don't need to uninstall. You just click the little button right there and say download now. It'll go through the setup again, and you're all set. If you have IT issues such that it's kind of difficult for you to download things, you can look at the release notes to see if it's worthwhile for you to download right now, or again, you can just use the online version.

All right, now we're just at the demo, so I'm going to take over the screen. All right. Hopefully everyone can see my screen, and I'm just going to get started. This is the home page of MEASUR. From here, you can go to calculators, you can view the assessments you've already made, or you can start new assessments, inventories, or play with the data explorer. Also over here you can see another place to add new assessments or inventories. You can see the assessments you've already made in the dashboard, and you can get to all the calculators and the settings and other useful bits of measure.

To start an assessment, you just click on whichever one you're interested in. If you click on these icons down here, it'll automatically fill out the assessment type for you. Name it something kind of interesting so you know what you're looking at. And if you've already made some folders, you can go in and set the folder you'd like to put it in. I'm actually going to hop into our example first.

Now, obviously each system is different, they're all unique, but they all more or less start off with this page that lets you set mostly your units if you want to be imperial, metric, or some custom setup based on whatever you normally use in your facility. Next, most of them will have an operations tab where you set things like how many hours per year that equipment operates, things like utility costs, and then some carbon emissions information.

Next you jump straight into performing your assessment. It's going to run you through data points that are needed to understand your system and calculate its efficiency or how much energy it's using. This is where everything is all different and unique for each

assessment, and some key things that I want to point out, there's some fields that you might not know what I mean, for example, pump type. That's very broad. It has a list of things right here, but that doesn't necessarily help. Each field has help text relating to what MEASUR is asking you for to help you try to figure things out. So from here you can look at these pictures and kind of say, okay, well my pump kind of looks like this and it's used for large section application, so I pick that.

In this case, you also have to put in information about the motor that's attached to the pump, and then some field data. It could be that you don't know your motor's full load amps anymore. The nameplate got damaged or whatnot. We have helpful little links right here, little buttons that will help you calculate certain fields, either with data already on the page or in this case, bringing up a new small calculator within the tool to help you understand and figure out how to calculate that value. Usually when there's enough data to actually calculate something, you will see a results tab over here instead of the help, and that will start letting you know what your baseline values are, so in this case, pump efficiency, going through the rated powers, motor efficiency, power factor, annual CO<sub>2</sub> emissions, annual energy, and annual cost and savings for each of those, which is unapplicable yet.

So the next step after you've established your baseline, the next step is doing the assessment. There's two different ways to do the assessment. One is called the expert view, which takes you back through the same fields you just went through and you just change the fields as applicable. The other view is a little bit more interesting. It's what we call the explore opportunities or novice view. Here you start with a list of common energy opportunities for that system and it provides you the data points needed to achieve that opportunity measure. So in this case, it's a new pump and motor. That's what I named it. We can either say I know what my pump efficiency is or you can use the internal calculations based on the HI Institute to try to estimate for your head in flow what is the best efficiency you can expect.

Then you can also change your motor to a more efficient motor. You can do multiple changes in one assessment. And you can see right here that doing these two things will save you about 9 percent of your energy per year. You can also have multiple scenarios, and they will just store in here. If you want to include information such as implementation costs. You will need to switch over to expert view, and it's a value right in here. And you can also add notes for your modification letting you know what you do so when you look

at your report later, you know what you were thinking.

Speaking of, the report. The assessments all have a page where it gives you the summary information that you saw earlier for each assessment so you can view them all side-by-side and see which assessments might – or which opportunities might be the best to move forward with, and you can look at the notes. We provide graphs. We love graphs. So in this instance, you can see where the different losses are in the two different scenarios we have selected and compare each scenario's losses. You have Sankey diagrams. These are nice. They just visually show you again where your losses are in the system. And finally, all of them have an input summary so when you print this off, you can see this is what all I entered. Each assessment also has the useful calculators for that system just right in here so you can get to it easily. So if you want to use a pump curve to build your assessment out, you can build your pump curve in here and have it just right there handy.

Next I want to take you to the dashboard. This is where all your assessments are stored after you've completed them. So you can see here our examples, one of each. You can see a summary of all of them right here, so if you have more than one of each type, it'll sum it all up and you can see the annual energy used and the annual cost for each of those. You can also do some – set some global settings for the folder, so if you are using the folder to represent a different facility, you can just go and put in the fuel, steam, and electricity costs and if you create a folder – create an assessment in this folder, you don't have to edit those fields individually anymore.

I'm going to hop over to my example folder real quick. You can see there's multiple pumps, process heating, and steam systems in here – or fan systems in here. From there you can click one of these and copy or move it to a different assessment. You can also do that here where you can rename, move, delete. Can use this to select all the folder content and generate a report. This report will summarize all the different assessments you have in here, giving you nice graphs of everything you performed assessments on, breakdown of energy source, and then it just shows you each of those graphs or each of those reports from the – that you already created, and for the rollup lets you choose which of the opportunities you want to use. It will automatically choose the biggest one, but if that's not something you think you will be able to do, you can just click on a different one and see the details change. You can also look at rollups for each system, and you can compare just within each system type your different assessments

you have done.

Finally, also very important, there's the ability to import and export different – or your assessments. You would just click on these. It asks you to name your file. It'll pop up here a normal window for saving things on your system. Just hit save, and now you have a file that you can e-mail to colleagues or your TAM to help understand better what's going on if you have questions or if you actually find a bug or something, you can e-mail that file to me and I can help you understand what's going on.

As many of you said in the polls, you've used the calculators. We have about 78 different calculators that are smaller, little, useful calculations to do just kind of on the fly. You don't need to do a full assessment. You know, maybe you just want to – you don't remember what your barometric pressure is up in Colorado. Or you want to do a bleed test for your pressure system, your compressed air system. Each calculator has a little generate example button that will give you some values so you can see what's going on, see what it looks like. Can reset the data, it takes you back. And so again, we have compressed air, fans, one lighting calculator, several motors, process cooling even though we don't have a process cooling assessment just yet. We do have several calculators for chillers and cooling towers. Process heating has quite a few calculators, several waste heat based calculators, pumps, steam. I love this one. You never have to go to a steam table gain. It's great because the TS diagram or the PH diagram. Calculators for each little tidbit of a steam system, insulation, flow down rate, and some wastewater calculators.

The data exploration is a nifty tool for getting started with the compressed air assessments. It takes sensor data and allows you to do a day type analysis which summarizes all the sensor data into different day types so you can model a year of data with relatively very few data points. And you can also use the data visualization tool to just look at your data in more detail, figure out, see if you find outliers, what's going on in these different plants. And as I mentioned, there is the motor inventory where you can set up different departments to put your motors in, you can decide which motor properties you want to track, and then you just have a tracking system. It will also very easily give you a summary overview of how much – how many motors and how much energy and cost they have in the different departments. And you can do a very quick, simple replace-rewind calculation to help figure out if you should replace a motor, if you should rewind it when it fails, or if you should replace it when it fails.

Finally, the last things I want to try to do in this very, very quick overview, the settings page. This lets you set globally anything. Any new assessment you make will have these settings, so you can set to imperial or metric, you can say you want your energy results to be in kilowatt hours, even if you're doing a process heating assessment. You can say I want to see the results when there's an option or the help. You can set global fuel costs. You can set a global ZIP Code for your electricity for CO<sub>2</sub> calculations. You can globally set your units. You can set if you want to see the tutorials as they pop up when you start. And finally, what I call the big red button. This is where you clear your data. You can reset all your data, the application settings, so the page we were just looking at. You can just reset the examples, something to do occasionally when updates come through so you make sure you get the latest examples. You can delete the assessments you have made, and you can delete the custom materials, which I didn't show you, but it's when you do a process heating assessment, you can actually create charge materials and whatnot so you don't have to input thermodynamic data every time you use it for something you will be doing a lot of assessments on.

And that is all I wanted to show in a very, very quick overview of MEASUR. If you have any questions at all, please e-mail me at [armstrongko@ornl](mailto:armstrongko@ornl). If you find any problems with the tool, please e-mail me. You can also, if you don't remember my e-mail, you can always go to feedback and use this e-mail address. It will eventually get to me. And I think that's it. Bruce, if you want to take things back.

*Bruce Lung:*

Okay, great. Well, thanks, Kristina. Nothing like keeping us on time there. I think I'll just add that this effort to upgrade the tools has been going on for about four or five years now, and it's really been a Herculean effort to take different tools that were created at different times by different developers and different programming languages and get them all on one platform. The key takeaways that I would suggest you all get from this is that they're a lot more user friendly than the old tools were. They're also conformant with the DOE cybersecurity protocols, and they're also aligned with the newer operating system, so you won't have any trouble using them in newer computer operating systems. So there's a lot of good things about them.

The calculators which we saw through the polls are wildly popular, and the nice thing about it is that the tools originally – the system assessment tools were designed to do an investment grade

interview assessment on that type of system. So for example, the steam system assessment tool or the steam system modeler tool for industrial steam systems. But the problem with that is that you need to collect all the data that you need and put them in those tools in order to conduct – get those kinds of results. The nice thing about the calculators is that if you only have a couple data points, you can still get some calculations and still get some value from these tools. So we definitely invite you all to look into them and see what works for you, and also if you get one of our in-plant trainings in Better Plants, we will be teaching the relevant tool for that training at that event. Did you want to add anything else, Kristina?

*Kristina Armstrong:* You covered a lot of really important points. Thank you. I guess in regard to the cybersecurity aspect, all the data is actually stored on your own computer. There's no server, there's no log-in. it is 100 percent free. You can just download it and use it or use it online whenever you want. It's open source, meaning if you have your own software that you're wanting to build and want to integrate some of this into it, you can do so if you adhere to the acknowledgements laid out in the open source license. And yeah, that's a lot of the key points. We've worked really hard on this, taking some tools that have been trusted for some of them over 20 years now, and hopefully you guys will use it and enjoy it and you can see next the – how other companies have already used it and found it helpful, so thank you all.

*Bruce Lung:* Thank you, Kristina. That was very helpful. One quick thing before I introduce our next speaker, I did want to just remind folks that if you have any questions, feel free to submit them in Slido. If you go to Slido.com, type in DOE and hashtag prompt, and then you'll be able to enter questions. If you use the chat box here, those are really for questions related to audio-visual issues, and our tech support just put the link in the chat for you all. I think it'd be better because you'll have a better chance of having those questions answered as people like them in the Slido platform. So please go to the Slido platform if you have technical questions related to the tools.

I'll go ahead and get started with our next presenter. We have with us David Rawls from Eastman Chemical Company. David has worked at Eastman Chemical since 2006 as a mechanical engineer. During his tenure, he searches for ways to save energy at the company and specializes in steam systems, which is good because Eastman generates a lot of steam. David graduated in 1981 from the University of Tennessee with a bachelor's degree in aerospace



engineering, and he later received a master's degree in mechanical engineering from the University of Tennessee in 1995. David, feel free to get started.

*David Rawls:*

All right. Well, thank you for that and great introduction. I do work here at Eastman Chemical Company. We're a specialty chemical company. The largest facility we have is here at Kingsport where I work, which is a 900-acre site that has a combined heat and power system that's equivalent in size to a 700-megawatt power station. So there's a lot of opportunity here to use MEASUR.

Our first encounter with MEASUR was back in 2019. We had some onsite training to use MEASUR to perform pump analyses, and so we – in all, we looked at six different pumping systems in the plant which comprised multiple pumps. Out of using the MEASUR tool, we were able to identify some savings on those – all the pumping systems. Two of the projects that we identified with MEASUR were implemented, and the rest are still under evaluation. Of the two projects, one was to trim an impeller, and the other was to replace an old worn-out pump, and it resulted in a savings of 1 million kilowatt hours per year energy savings.

In addition, we have numerous turbines here. We have 19 turbine generators in the plant, and plus probably dozens of other turbines that are used for other purposes. And so the MEASUR calculator for turbines comes in handy. And what I have here is a representative of the input and output conditions we have using the MEASUR tool for turbines. So we have a 6,000-kilowatt turbo generator that takes in 600 PSIG steam that's at 750 degrees Fahrenheit. Isotropic efficiency is 75 percent. Energy out is 21.6 MMBtus per hour. Generator efficiency is 95, and then the power out is 6,000. And then below you can see what MEASUR comes out with as far as the enthalpy, the mass flow 163,000 pounds an hour, specific enthalpy, specific entropy, and then the energy flow of 225 MMBtus per hour. And that's how handy that turbine calculator is as it can give you all these outlet conditions based on the inputs you have.

Insulation is very important here at the plant. We have over 15 miles of main steam headers in the plant plus probably tens and hundreds of miles of much smaller headers, and so with insulation, you can not only tell the effect of adding insulation to piping, which you can also do with 3-Plus, but also you can use the insulation calculator in MEASUR to evaluate adding insulation to tanks. And C3E-Plus, which is a widely used insulation calculator that's online, doesn't have a slot for tanks in there. So MEASUR is

valuable to us because of that. And as an example, I have here – we have – this is a typical tank 20 feet in diameter and 20 feet high. I've evaluated adding four inches of insulation to it. Internal temperature is held with tracing at 250 degrees Fahrenheit. Our average temperature here in Kingsport is 55 degrees Fahrenheit, and then we use natural gas as our primary energy source. But using that MEASUR tool, then that tells me that the heat loss is 387 MMBtus per year. If we modify it, that drops to 210 MMBtus per year. Energy cost goes from \$3,875 down to \$2,108, and that gives us an annual cost savings of \$1,767.

MEASUR has a very handy calculator for motors. It helps us to figure out what the motor power curve is based on just inputting the type of motor we have and the nameplate. So we can determine what the power is for various speeds and everything. That helps us to determine if a variable-speed drive would save us a lot of money if we put it on a motor. User inputs consist of frequency, power, RPM, and efficiency, which are all nameplate, and then if full load current is unknown, MEASUR will even estimate the full load current for you.

Here's something that I wish we had a long time ago is MEASUR has a calculator for climate data. If you're going to study like an HVAC system, it's really good if you know during the course of a year how many hours of the year your local climate spends at a given temperature, pressure, or humidity. One way you can do it is to go to National Weather Service or Weather Underground, but that's extremely laborious. You just have to tease through all the data by yourself and kind of make estimates like during the day, okay, I think there's maybe an hour at this time or whatever. MEASUR makes this extremely quick. You go onto MEASUR, you input your ZIP Code in or another identifier, and then it gives you ranges of temperature and specific temperature and humidity, and it'll tell you during a year typically how long you spend at each range. That is extremely handy and it saves a lot of time for HVAC analyses.

So in summary, I like MEASUR. It's very easy to use. It has numerous engineering calculations all in one place so I don't have to go hunting for things. Both initial download and updates are free. Can be used for full energy assessments like we did for the pumps or for individual calculations, and there are tools for pumps, insulation, motors, and steam equipment, which I find handy. And thank you very much.

*Bruce Lung:*

Thanks a lot, David. Sounds like you all got a lot of value from the tool so far, so hopefully that'll continue into the future. One quick note before I introduce our next speaker. I notice that there are a lot of questions coming in, and if you could, please specify if you want them to be answered by either Kristina or any of the other panelists. It looks as though the majority of the ones I saw may end up going to Kristina, but if you want a specific panelist to address them, you can please add their name – like first name, and then we'll go from there.

Now I'll go ahead and introduce our next speaker. This is Prasath Vinayagamoorthy. Sorry if I mispronounced it, Prasath. But Prasath has worked at 3M for over seven years overseeing energy management and energy management information systems for the US-Canadian operations of the company. He leads the implementation of ISO 50001, the energy management standard within the company. He also works with ISO50001 SEP energy management systems and identifies energy savings opportunities through energy assessments, energy hunts, and energy walk-throughs, but he also performs technoeconomic analyses for all energy-related projects. In 2019, Prasath was awarded the Association of Energy Engineers Canada Region Energy Engineer of the Year, and in 2018, IESO Energy Manager Award in Ontario. Prior to 3M, Prasath had worked at Michelin and Exide Industries. Prasath, feel free.

*Prasath Vinayagamoorthy:* Thank you, Bruce, for the introduction. I am here. I am just going to give you a quick overview about the energy management at 3M and how we use MEASUR tools for support these activities. Just starting with the value 3M, so 3M, our systems run like power like people, I guess, and science and creating imaging. And our promise to the people is we improvise by helping solve the world's biggest challenge. Again, we are people of the industry here at 3M and we make products – about more than 50,000 different products like from sandpaper to window films and medical tapes and all other kinds.

So again, I am going to go over goals. Four best areas are the main three focus area is Science for Circular, Science for climate, and the Science for Community. And my main focus is Science for climate. So we have different testing because starting here, so our focus is main on – my focus is more – mine and my teams focus on climate and energy, and there are climate and energy are out main goals so to improve energy efficiency by 30 percent in external sales, increase renewable energy 50 percent of our 2002 baseline by 2025, Reduce scope 1 and scope 2 emissions through image and

by 50 percent by 2030, 80 percent by 2040, and carbon neutral by 2050. And the last goal is to help our customer reduce their GHG by 250 million tons of CO<sub>2</sub> through our 3M products. So these are our goals, and we work on that. Again, 3M is committed to different sustainability goals RE 100 then we work with Better Building and we are part of Better Climate Challenge as well. We do support our goals and common goals.

How are we addressing these climate and energy goals at 3M? So main focus is on energy efficiency because we believe energy efficiency will help our renewable goals and GHG goals. So energy efficiency's the main goal which we focus on. Under that, how we're doing is the energy management system, so we work with environmental energy management system to make sure that we have a process dedicated flow to work on energy at all sites. And the second thing is energy monitoring and reporting, so we know that we are not measuring it so we focus on monitoring and sub metering. And the last one is update technology. We were trying to bring new technology into the systems, to the site, and also we want to bring more technology changes at the same pace.

Again, as I said, for data, data is key. We want to measure it so we can control it, we can report it, so we had different systems in 3M to get the data into the system and monitor and share it. So we have different database to do that. And again, about energy management system, just a graph to show you how the energy management system works. So if you see the first half of the graph, you work on, you audit, you work on some projects, you register your energy, and then under control and then, you know, focus on it, then the energy increases, then you go again projects to bring it down the cost. But standardized energy approach is what we are focusing with ISO 50001 and the CP's we are getting senior management commitment and then we are starting low hanging fruit savings then we are going energy advancement measures, and then it becomes as in company culture to focus on energy.

This is just to show you how our ISO 50001 works, effectiveness. So we just calculate difference between the savings between the non-ISO sites and ISO sites between our sites, and we have seen 2.2 times higher energy savings and cost savings by ISO site implementations. Currently we have certified 56 sites globally for ISO 50001, and about 40 sites in this continent, in US and Canada and Mexico.

So ISO, so how this MEASUR tool is supporting us. So this is the one graph that measures every energy review we do for supporting

ISO 50001 every annually, and I use this tool for some other sites to calculate how better the area focus, where can we find opportunities, and again, given the cost here by just so by doing whatever activities we introduce, energy and we will not be contained to the next step of doing the project and working on this project. This is another one type of analysis we do on the system, on the energy improvement, okay, where we need focus but other project we can do using this tool. Different calculator that we use for our easy calculations like cost reductions and identify smaller projects, easy projects so we do the individual calculations here.

Again, as I said, we want to bring this in the same vain so right in the beginning of the project or when we want to expand the project to a renewable upgrade, so we made some changes internally within 3M, and I am going to show you how the MEASUR is supporting in that. So one example I tell is that the site gives us 285 PSI steam pressure head what process, and we have one process that doesn't – that's need 285 PSI but other steam process need stronger head pressure. So during our sustainability process we were doing an assessment on this to determine what are the energy savings on it. So here you can see that we are right there operating at 285 PSI, and we were calculating energy savings from one part of the steam header, and then we decided to go with a boiler to support 285 PSI and then rest of the boilers to support 104 PSI. So by separating this, we were able to save energy in building our MEASUR interface and support our integration of sustainable impact design.

Another thing we do at 3M is Energy Treasure Hunts. We do at other sites like with help of DOE so we do that. So Energy Treasure Hunts is one we do and we identify the projects, build up the habit for our continuous improvement. Again, here is the MEASUR tool will help us with energy efficiency. This is just an example that we had, so we used to use this tool during our Energy Treasure Hunts, identify the project. We just put into that and calculate the energy savings, implement a task to find what the low cost. We need to focus right now on what will be the project that's high cost that need to be focus, we separate that, and we have this table developed to send to the top management to get some more support on it. So this tool's helped us in doing all this Energy Treasure Hunts identification and calculating it in the easy way. I think this is my last slide. I have just given a couple of examples about the use of MEASUR tools but that's calculations improvement with this MEASUR that we are using it and we plan to use more on that. Thank you.

*Bruce Lung:*

Thank you very much, Prasath. That was very insightful. I'll go ahead and introduce our final speaker today. Today we are happy to have Jonathan Settell from Valvoline. Valvoline joined our program a couple years ago, and they've been doing really well. Jonathan is a professional engineer who has a Bachelor of Science in chemical engineering, and he's also a licensed professional engineer in the state of Kentucky. During his career, he has been heavily focused on manufacturing and supply chain operations. Currently he works as a senior engineer with Valvoline headquartered in Lexington, Kentucky, where he provides global engineering support to his organization, construction and project management, process design and optimization, financial analysis, risk management, and general technical support for all the Valvoline sites. He works with almost every continent and with all levels of the organization. So with that, Jonathan, take it away.

*Jonathan Settell:*

Thanks, Bruce. Just about us real quick, Valvoline's a worldwide supplier of automotive products and services, so here in the US we operate a little over 1,500 quick lube chain stores, but also on the side we have a robust manufacturing and supply chain operation basically around the globe, almost every continent except Antarctica, and we manufacture lubricants, antifreezes, performance fluids, transmission fluids, kind of the works there. We're headquartered in Lexington, Kentucky, but we have, again, a global supply chain mostly here in the US and Canada but also some international locations – China, Australia, a couple places in Europe, and JVs around the world. We have a very diverse operation. There's varying levels of blending, packaging, and logistics operations everywhere, almost 10,000 employees worldwide, and we're a partner in the Department of Energy Better Plants program. We're in – we basically – we have a goal to reduce 25 percent of our energy intensity over the next ten years, so we're working on that.

So we have a couple challenges within Valvoline and executing to both the ESG goals and also our financial performance goals, but one, we're a very diverse supply chain, so presence pretty much everywhere, but there are a few key locations, so distance between areas. So with that you get a lot of geographically, operationally, and culturally different locations that you're dealing with. So we have a challenge in rolling out the standardization across all those sites, having goals that mirror up to the different methods for process execution. There's a mixture of thermal fluids, steam, air mixing, side mixing, top mixing, and then a lot of pump processes. And then, finally, there's varying levels of automation throughout the processes, and manual operations versus semiautomated versus

fully automated. We're also looking to shift more toward green manufacturing, so that kind of falls in with the Better Plants pledge and minimizing our environmental impact. Some assets are in need of recapitalization, so basically replacing those in a sensible manner. Exercising business intelligence, looking at data from our ERP systems and the plant outputs, and then also just executing to our business goals and prioritizing what we want to look at basically throughout the operations.

So the MEASUR tool, I was introduced to this early last year, 2021, and we found it useful because it's kind of a – it's an off-the-shelf software that gets periodic updates. When you're sharing this with people, it carries some weight when you tell them that the Department of Energy basically developed it. So there's a little bit of trust that goes into when you share it with your downline customers within your company. I like it because it's a consolidated source of knowledge that general users can use. You can have facility managers, supervisors whip out this tool and use it, and they don't necessarily have to bring out their Perry's Chemical Engineering Handbook. Everything's all right there. You just punch in the numbers and you can do a quick analysis of your system. So Kristina already talked about it, but there's calculators for steam pumps, compressed air, and lighting replacement, and others.

So we primarily use it for understanding kind of business objectives. So if you put in your system, basically you can go out and basically construct your operating conditions, and then from there you can perform scenario analysis. If you're running a project, you might do a sensitivity analysis to do – to understand some of the financial benefits. I always find doing scenario analysis is also beneficial because you can get some real realistic understanding for different conditions. And then you can take that and do returns on investment, understand cash flows, and evaluate different tenants and projects to execute on. The graphics there kind of show the scenario analysis benefits of MEASUR.

So kind of the way I tell people to go about using this is just establish your base assumptions. You can give this to basically anybody downline in your supply chain, and they can construct their case using base assumptions, build the system out, and then perform any kind of iteration process modifications to your assumptions from there on. So kind of here there's a pretty rudimentary process flow diagram for a steam system and a couple of iterations of if we change this, then what's the benefit; if we change that, then what's the benefit. And you can get things like

cash flow improvements, savings on water, savings on CO<sub>2</sub> emissions, kind of the works.

So in summary, it really helps with interdisciplinary communication. Not everyone is schooled in kind of the technical matters of steam compressed air systems, so if you're talking to somebody that's not necessarily educated or trained in those, it's an easy way to translate that information for them to better understand it. It gives your operations team a toolkit for, you know, they can do quarterly or annual health checks on their own systems, do predictive maintenance, and size their own equipment. And it also provides a standard for – a reference for standardization. There's a tool for multilingual support, so it's got a Google Translate function in it where you just click it, select your language, and then say another user can easily use it in their own understanding. So that's kind of it. We've used it for many opportunities, both steam, compressed air, LED replacements, pump assessments, and it's been great for us. And I think that's it.

*Bruce Lung:*

Thanks a lot, Jonathan. It's really interesting to me how all these partners have used the tools in different ways and have gotten value from it. Especially interested by the scenario planning that you all did at Valvoline there. There were questions asked about LEDs and water savings, and I think Jonathan pretty much covered them. So you can use the tools for those kinds of resources as well. I'll go ahead right now, and before we do the Q&A, just want to thank all of our panelists for the presentations and encourage you all to download the additional resources handed out and shared in the Zoom chat just right now. This handout contains a lot of links to resources from the Better Buildings program and our speakers on today's topic. We hope that you all find this useful.

Now I'll move on to the Q&A. if you haven't already done so, we ask that you go to Slido and enter the event code DOE. It looks as though we have plenty of questions, and I apologize ahead of time. We may not get to all of them, but I'll go ahead and start with some of the most popular ones. We have an anonymous poster who said, "If you have several sites, is there an Excel that can be sent to different facility managers to collect data needed to input in MEASUR?" My interpretation is that – I think what you're asking is whether we can send a spreadsheet to different facilities, collect their data, and then put it into MEASUR. I know – Kristina, do you want to take that?

*Kristina Armstrong:*

So we do have an Excel data entry form for process heating. You can find it at the [BPTraining.ORNL.gov](http://BPTraining.ORNL.gov) process heating training



session. But overall, my suggestion would be to send your different facility managers MEASUR and they can export the assessments back to you. Even if everything isn't fully completed, they can still export things back to you so you can aggregate them and tidy them up as you need to.

*Bruce Lung:* Thanks very much. The next question with the greatest number of likes is are any recorded trainings available. And my sense is that we do have recorded trainings called the virtual implant trainings, and we can provide that separately to you all, but I don't know, Kristina, if you have anything else to add on that.

*Kristina Armstrong:* We have an older webinar that we did, I want to say October 2020 maybe, where I went over MEASUR for about an hour, but I would suggest going to the virtual in-plant trainings, again, at [BPTraining.ORNL.gov](http://BPTraining.ORNL.gov), and there you will actually get system-specific tutorials if you find the right one, and that will help. They all used MEASUR when they can.

*Bruce Lung:* Great. The next question we have here is how is it possible to join an onsite assessment to learn how to use MEASUR tool? And my best answer for that is that, you know, we do have in-plant trainings that are plants. Some are virtual, some are in-person, and we just simply invite you to check with your technical account manager to find out who's getting what onsite assessment, and then we'll work to make it possible for you all to attend it.

There's a question from Max, who asks if the assessment can handle optimization of banks of equipment, for example, five refrigeration chillers. And I think, Kristina, you said we're working on a process cooling application.

*Kristina Armstrong:* We are working on a process cooling assessment. Right now, I know there's the different chiller calculators do have inputs for putting in multiple chillers, so I would check those out. But I know chillers do operate in multiples, so I imagine when we do get that assessment in, it will be able to handle multiple chillers at a time.

*Bruce Lung:* And now one over to David Rawls here. Could you chat a bit about the training you received on MEASUR? Was it one-on-one and did you have to pay for it?

*David Rawls:* It was – we had an instructor come in and give the training to a group of us, and I don't recall there being any cost of that. I might be wrong because I didn't handle that end of it, but yeah, it was a group of us that received training.

*Bruce Lung:* So it was probably one of our in-plant trainings, and there is no fee associated with those. The DOE will cover those costs completely. A few other questions here. I think I'll take maybe one or two more. Somebody asked is there a plan to make a detailed tutorial for MEASUR?

*Kristina Armstrong:* I am very slowly working on algorithm documents, but those are more related to the math. In the slide deck for this webinar, there is actually a slide deck version of a tutorial. I didn't only just have those three slides. It goes through everything I mentioned and more, so that might be a good place to start. And again, there's older webinars you can look for in the Better Plants training.

*Bruce Lung:* Okay, terrific. Another quick question that came in here is whether projects such as daylighting window films can use MEASUR to show ROI, heat loss, and energy savings by installing film rather than window replacement. I don't know that we go into the facilities so much, but I don't know, Kristina, if you want to address that real quick.

*Kristina Armstrong:* I'm going to go with not that I know of. We only have the one lighting calculator, and that's basically replacement. Okay, that's more of a building – no, not right now. If you have an Excel calculator that will help us put one in, we will accept suggestions for calculators, but right now we do not have anything related to that.

*Bruce Lung:* Okay, thank you very much. I'm going to have to cut it off now because we're right about at time. We do hope that you all will join us on our next webinar on Tuesday, December 6, "The Thrill of Bills: Leveraging Your Water Bills to Maximize Energy Efficiency," where you'll learn about how to understand your utility bills, strictly water ones, and how rates can maximize your cost savings through energy efficiency. I'll also mention that our best Better Buildings Better Plants summit will be April 11-13 next year here in Washington, DC. This will be an excellent opportunity for attendees to network with their fellow industry peers and experts. We will be in-person in the heart of DC. Registration's coming soon so please visit the Better Buildings Solution Center to learn more.

And with that, I'd like to thank our panelists very much for taking the time with us today. I'd also like to thank folks who stayed on through the end and asked questions. We had some really good discussion. Feel free to contact our presenters directly with

additional questions. I expect we have their contact information right there. And then I encourage you all to also follow Better Buildings Initiative on LinkedIn and Twitter for all the latest social media and news. You can find our handles by the respective icons on the left hand of the slide. You will receive an e-mail notice when today's recording, slides, and transcript are available on the Better Buildings Solution Center. Once again, thank you all for joining today. I hope you have a great week.

*[End of Audio]*

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**MEASURING Up: Leveraging the Capabilities of the MEASUR Tool Suite**

## Additional Resources

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

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- [Download](#) MEASUR Tool Suite
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