Eli Levine: Hey, everyone, good afternoon. We're just gonna give it a minute for everyone just to jump in and then we'll get started.

Alright. Well, welcome, everyone. We have a big crowd today, which is really exciting to see. I hope you're all doing well, and I'm sure everyone has exciting, big Memorial Day weekend plans with lots of travel and getting together—I'm joking; I hope everyone's staying safe and relatively sane out there. We're really excited to kick off today's webinar, number six in our Online Learning Series, focused on water efficiency.

In case I haven't introduced myself yet or you haven't heard the sound of my voice before, I'm Eli Levine with the U.S. Department of Energy. I have the privilege of leading our Better Plants program. Next slide.

So, as I mentioned, this is the sixth and final in our initial series for the Better Plants Online Learning Series. If you've missed any of the previous ones, we posted them all online, so you can watch the recording online and, should you have any questions or any more information, just reach out to me or my colleagues and we're happy to answer any questions that any of the Online Learning Series has triggered.

We've been really blown away by the participation level and the interest level and how these have taken off. We did a poll at the last one and the response was really favorable. So, I think we're excited to come back with more, we will note in the future slide, we have a couple of exciting events coming up in the office. We have the Events Manufacturing Office peer review in a week or two, as well as the Better Buildings, Better Plants Summit. So, I think our goal is to let those go by and then we will launch a new season two of the Online Learning Series with all sorts of new topics based upon the input that you guys provided. And by all means, if there's any new topics that you would like to see that we haven't covered yet or if you have something as a partner that you would like to share, please let us know, we're happy to listen to you and take your feedback and try to accommodate all of your requests.

So, as I mentioned and the slide indicates, upcoming June 8th through 11th is the Better Buildings, Better Plants Summit. We're really excited for this, although it's a shame we can't be together in person. It's a virtual leadership symposium. It's free to register and you don't have to negotiate any travel budgets or combination budgets with your work, just hop online and join us for these. It should be a really exciting couple of days. You see the link down there to register. I think we're up to 1,400 something, so it's quite a significant number of folks that have registered already, so it should be a great couple days, but we definitely want our industrial Better Plants family to be there to be with us. So, please sign up if you have a chance. Next slide.

So, with that, I'm excited to introduce Kiran Thirumaran with a lovely break from Tom Wenning, we're giving him a chance to relax and just take these in, and Kiran, I'm expecting to do a really wonderful job. Kiran's been with the program for four years now, he's an expert in water efficiency, he has a portfolio of roughly 15 to 20 partners that he's been working with the whole time and they've, a lot of his partners are some of the standouts in the program, so whether I give Kiran credit for that or give the partners credit for that, I'm excited. It's great to have Kiran part of the team and I'm excited to hand it over—Kiran, over to you to teach us all a little bit something about water efficiency.

Kiran Thirumaran: Alright. Thank you, Eli. Good afternoon, or good morning to everyone, depending on where you are joining us from. Glad you are able to join us today.

So, as Eli mentioned, over the last few weeks, we had looked at energy, right? We started off with some of the fundamentals of energy, and then we moved on to take a deeper dive into specific systems.

Today, we will pivot a little bit and talk about water and water efficiency in manufacturing. We know water is critical to manufacturing, but water optimization and water efficiency usually doesn't get the time and effort it deserves, right? At least not as much as energy efficiency, and for obvious reasons. So, water, in a lot of cases, is relatively cheap and it's really hard to justify water efficiency projects. So, today, hopefully, we will try to address this a little bit in our small way and, so the webinar is set up like a primer to manufacturing water efficiency, and being so, we're gonna be covering a lot of different topics, from water use and manufacturing to common opportunities and so on and so forth. And hopefully, by the end of it, each one of you will have some nugget of information that you can take back to your organization.

Also, just to be on the safer side and avoid any potential disruptions, I did record the webinar yesterday and we'll be going through the slides with the recording. But as we go through it, please make use of the chat box in the GoToMeeting dialogue to get your questions sent, right? So, we'll have a question and answer session at the end and we will get to those questions.

With that, I think, Marissa, we can jump in.

So, water efficiency in manufacturing. As mentioned, we're gonna be talking about a lot of different things as part of this webinar. We're gonna be covering key concepts, we're gonna be looking at water efficiency opportunities, some of the DoE resources out there. But before we get into all that good stuff, I wanna start off kinda like giving a context to why the Better Plants program and Department of Energy in general is interested in water efficiency, right? And the reason is the interdependency between water and energy. So, this water energy nexus, it exists at a national, regional, and also at a facility level, right? So, at the facility level, we constantly use energy for water. So, to pump water to the point of use, and also for treating the water to the required quality, right, we use energy—and vice versa, we also use water in electricity generation and so on and so forth.

So, being aware of this water energy nexus is good. It helps us evaluate our projects better, so kind of like knowing the impact of water efficiency projects on energy or the effect of energy efficiency projects on water kind of like gives us a holistic approach to evaluating projects.

So, moving on to giving a quick snapshot on water use in the manufacturing sector across the U.S., at a high level, U.S. industries use 20,000,000,000 gallons a day; that is, around 5 to 6 percent of the U.S. total, 15 percent of that is consumptive, meaning it is lost as evaporation or goes into the product itself and cannot be reclaimed. The majority of the water is self-supplied as shown in the pie chart; only a small percentage, 25 percentage is actually got from the city, right, it’s paid for.

So, digging a little deeper into the self-supplied water and charting it across the U.S., we see the states with, that are more industry intensive have a bigger water footprint, right? So, states like Texas and in the Midwest definitely have a bigger impact on water consumption, and the chart at the bottom kinda like breaks down the water, the self-supplied water use from its source groundwater to surface water.

So, having this information is good. Knowing where water is used, how water is used across the U.S. manufacturing, but what would be really useful and interesting from the manufacturer perspective on how water is used in specific sectors, right? Unfortunately, we don't have the data for the U.S. and the closest data that we can refer to is the ones available from Canada. So, the Canadian Statistics Bureau does this survey once every two years to know the water use in the manufacturing sectors in Canada, and this kinda gives a snapshot on some of the data that is published. So, the one at the top gives the recirculation percentage as well as the intake and discharge plotted across historic years, and the graphs to the bottom kind of give us a snapshot, for each industry, how the intake water is used and how it is treated in the various sectors.

So, this raw data might not be accessible for everyone, and might not mean too much in its raw form, but we're gonna be coming back to this data set when we are talking about some of the DoE resources that we have built around this data set so that manufacturers could make use of it, right?

Moving on to the reasons to look at water efficiency and some of the benefits that it provides manufacturers—so, outside of the obvious cost savings to the direct and indirect cost component that comes with it is also the reduction in business risk. So, water efficiency kind of reduces the impact of potential disruption to the water supply or an increased government regulation could have on the facility. At the same time, it also improves the reputation of the organization—again, because water efficiency is closely tied up to sustainability and corporate responsibility.

So, we know the benefits for water efficiency—how do we go about managing it at our organization and at our facility, right? So, in an ideal case, we want directions to be set up at a corporate level. So, there are a few things that one can do at a corporate level to kinda like set the directions right for facilities to implement some of the water management strategies, right? So, some of the things that could be set up on a corporate level is establishing water efficiency goals as well as a baseline for the water usage in the organization so that it could be tracked over time, at the same time, prioritizing facilities and setting focus areas is something that could be done at a corporate level as well.

So, the picture on the slide kind of talks—kind of, like, gives a snapshot of the water stress in the U.S. and it is picked out of the World Resource Institute's aqueduct tool. So, this is a very simple to use tool that you could pretty much go and put your facility's address in and know what is the water stress in the area, right? And another key feature of the tool is, you can also forecast what the water stress is going to be like in that specific area.

So, based on this, there is a lot of organizations that are setting up priorities for facilities and target for specific facilities based on the water stress in the area, and that could be something that could be done at a corporate level as well.

So, corporate level, it is good to set directions, but the actual actions have to be coming from the facility itself. And so, these three steps that they have laid out can be thought about as a water assessment or three steps to managing water in the facility, right? And we're gonna be going through them one by one and exploring these concepts a little bit more in detail.

So, baselining water usage—what do I mean by water baselining? What I mean is pretty much an end to end mapping of water flow in your facility. So, right from where you're getting it from your waterway, your source maybe, to how it is getting used in this system, how much water is getting used in specific processes, how much is lost, how much is being recirculated, and how much eventually goes to wastewater treatment and to the discharge, right?

So, you want to have a good understanding of the end to end water flow in your facility. And this involves understanding where water is used, how much water is used, and what its source and discharges are, right? And so, this water baselining might be very simple and straightforward if you have a good understanding of where water is used in the facility and you have good submetering in place to kind of know how much water is used. But we know that, in a real world situation, that might not be the case always, right? It might not be possible for all the facilities as well.

So, one of the techniques, kind of a strategy or technique that you can use for doing this water baselining is what we call the water balancing. And it is as simple as it sounds. Pretty much what you want to make sure is, the total water being used in the systems, like, the sum total of all the water used in the systems, is equal to the total water intake and at the same time, total plant water intake also equals to the plant water outflows, right? And when I mean outflows here, I'm not just talking about facility discharges, but also evaporative losses, water that goes through the product, so on and so forth.

So, when we do this balance, what we find is, like, if there is a huge difference between those two, then we know there are unknown losses or unknown water uses that we are not accounting for and then that we can go back into the field and try to investigate and find those. So, water balancing gives you a good way to construct this water mapping or water baselining.

So, baselining helps benchmark and set targets. So, what is that? So, if you're able to do your baseline of your water consumption at your facility for this year, that kind of helps you track your water consumption year over year, right—in specific systems, how much water is being used this year versus next year, and that kind of like helps you benchmark against other facilities and also set targets for yourself to see if you're improving. So, the first step to kind of, like, improving is measuring, and baselining provides that first step that is needed to start on your water management efforts.

So, once you're doing with baselining and have a good understanding of how much water is used and where it is being used, the next step is to data mining the true cost of water and let's talk about this a little bit more in depth. I know we alluded to this concept a little bit, but let's define it.

So, what I mean by true cost of water, right? So, as I mentioned, the total cost of water is not just the direct cost associated with the purchased water and what you pay to your sewer treatment, but all the other indebted cost components that goes into it, like cost associated with treating the water, cost associated with pumping it to its point of use, to any chemicals that is added to it, heating or cooling it, so on and so forth. And this is gonna be unique for each facility. So, even if you are making the same product in two different facilities, the true cost components is going to be different, because again, your sources of water could be different and the way you take care of the waste water treatment and waste water discharge could be different as well.

One of the caveats to note here with respect to the true cost of water is—so, it is good to kind of, like, aggregate all these indebted costs to get a sense of how much total money that you're, how many dollars you're actually putting in, into using set gallons of water, right? So, that is the true cost components. But when you're evaluating projects and trying to identify how much cost savings you will get out of it, then you probably want to re-evaluate your true cost components you need for each project, right?

This might sound a little bit complicated at first, but it's pretty straightforward if you think about it. For example, let's say if you have a recirculation project that you're thinking about, then you don't want to include, say, costs associated with pumping the water around, right? Because that is—though you will be saving on the volume of water, you are not gonna be saving on the pumping energy associated with the project. Or, on the other hand, if you take a leak reduction project, you're fixing a couple of leaks that you found in the system, then probably, you're gonna be saving on the pumping energy as well as the other cost components associated, as long as you have, your pumps can turn down accordingly.

So, that's with respect to true cost. Now, to kinda get a sense of the magnitude of the true cost, right? I just have an example of the true cost components broken down for a pulp and paper manufacturer, right? Again, this is for a specific facility, and if you look at here, like, the municipal and the sewer cost, the direct cost components, it's pretty much just like 2 percent of the total. In this case, of course, they have a lot of different things that you might not come across in your facility like value of chemicals and product that is lost in the wastewater steam, as in pulp and paper manufacturing. But some of the other things that do add up to the true cost components quite a bit, like chemical treatment, energy for pumping, third party disposal, so on and so forth, which are pretty typical in a lot of manufacturing.

So, again on this graph, closing the loop with respect to the water energy nexus, the embodied energy in water is given by the energy to pump and also in the heat that is being lost in the water itself going out.

So, what is true cost? Why is true cost important, right? So, one, of course, it reveals the hidden costs associated with the water consumption, quite obvious. Another one is, it kind of, like, helps you identify water use intensive systems versus cost intensive systems, right? And let's take a look at these two pie charts to understand that a little better. So, I'm looking at the red pie in both the pie charts associated with boilers for facility, and if you look at it on the left hand side, for the source water intake, it says 13 percent of the total water use in the facility is used for the boiler, right? So, that is based on the gallon. So, if you look at the graph to the right, even though it uses just 13 percent of the water, it is associated with almost like 26 percent of the total cost associated with the water consumption. So, and that is why you'll be able to identify which systems you want to target first to find opportunities and so on and so forth. Because, as in this case, boiler probably needs a lot more water treatment before it could be used as a makeup water for the boiler, and that kind of adds up to the true cost component for the boiler water.

Alright, so, coming to the next bit, now that we have our baseline water use, we know how much water is being used and how much it is costing us, then we can effectively identify water efficiency opportunities. So, not that we won't be able to identify opportunities without finding true cost—definitely, we'll be able to—but once we, following these steps, we'll be able to associate the true costs calculated to find the true savings from those projects.

Water efficiency opportunities by system—so, we're going to be looking at three different systems and the top five opportunities in each of them, right? So, we're gonna be looking at cooling and condensing system, boiler, and process equipment. So, the first one I have is the cooling and condensing system, and from the perspective of water consumption, the major component of your cooling and condensing system is gonna be your cooling tower. So, that's where you add your makeup water into the system itself.

So, a little bit of fundamentals of the cooling tower before, and how water is used, before we go into the opportunities itself. So, we have warm water coming into the cooling tower which, it kind of cools down and sends it back to the facility, right? So, it removes the heat coming from the chiller generated at your process equipment. So, the way it does it is, so the warm water coming in gets sprayed on top of the cooling tower and, as it flows down, it comes in contact with air that is coming in the opposite direction being pulled in through the cooling tower fans, and in this process, the water gets cooled down by the evaporative effect.

Another thing that happens as it gets cooled down is, the minerals that are there get solidified and drops down to the cooling tower sump. From there, it needs to be blown down so that it doesn't get added up.

So, two things to note here is the blow down and the evaporation, right? Because the blow down, in addition to the minerals, also removes water, and of course, we have evaporation that loses water as well. So, the makeup of water that we're gonna be adding in into the system is gonna be the sum total of the water lost through blow down and evaporation.

Another key metric to note while talking about cooling towers is the cycles of concentration, which is the ratio of the makeup volume divided by the blow down volume, and it kind of gives us an indication of the performance of the cooling tower, right? Pretty much what it is, is how many times you're recirculating the water before essentially throwing it out. So, the higher the number is better and five to six cycles of concentration is something that is achievable on a cooling tower.

So, coming to opportunities, the obvious first one we have is optimizing blow down, so increasing the cycles of concentration. So, some of the ways we can do this, one way is definitely improving the quality of water use. So, if we are able to treat the water on the front end, then we could be increasing the cycles of concentrations proportionately. Another way to kind of increase cycles of concentration and optimize blow down is to put in an automatic blow down control, especially if you're having manual controls being operated on a schedule. And automated blow down controls, what it does, it continuously monitors the conductivity level in the tanks and blows down whenever necessary.

The second one I have is fixing leaks. Quite obvious, not just for the cooling tower system and associated piping, but wherever in the facility, as soon as you are able to find it, fixing it is a good practice to have.

The third one I have is eliminating single pass cooling. So, single pass cooling or once through cooling, is essentially when you use water to remove heat in a heat exchanger or from a process and then pretty much dump it out, right, without recirculating it within the system or through a cooling tower. So, this is definitely not an advisable practice, except for in very specific situations where the water comes in contact with the product and you have contaminated water that cannot be recycled or reused.

So, the fourth one I have here is again associated with cooling towers. So, drift eliminators are kind of like additional panels that you can add on to your cooling towers, some of them. Most modern cooling towers come with these drift eliminators. What they essentially do is, they decrease the water droplets from escaping with evaporation and pretty much reducing the losses associated with the cooling tower itself.

So, the last one I have is recycling and reusing opportunities in these cooling and condensing systems. So, I just wanted to define these two terms here because, again, we'll be coming back to it when we are talking about boilers and process equipment as well. So, recycling is when you are able to—when you need to treat the water before you can apply it in another application and reusing it, and you can take the water as it is and use it for a different purpose, right?

So, pretty much the water stream in our cooling and condensing system is pretty much the water, the cooling tower blow down which, again, has a really high conductivity, right? So, it is really—it's gonna be really tricky trying to reuse that water. Maybe some of the application you will look at is pretty much in landscaping. Some of the plants could take the water directly from blow down. So, reusing might be tricky, but recycling is, again, definitely an opportunity, but the only thing there to note is the economics, right? Would it be worth chasing the blow down water and having water treatment for it to be reused?

The next system we're gonna be taking a look at is the boilers, and formulary the perspective of water consumption, this is gonna be very similar to your cooling tower system, with the only difference being in the condensate return, right? So, with boilers, not all the steam that you send into the plant is returned as condensate, and there is a loss in that as well and we need to make up for that loss in the makeup water that we add in.

So, moving to some of the opportunities in the system, the first one is very similar to the cooling towers. It's minimizing blow down, and optimizing the cycles of concentration, and all the points we discussed for the cooling tower also applies for boilers as well in this case.

The second one is with respect to increasing condensate return, and this is a big opportunity that exists in your boiler and steam system, right? Because this condensate, what a condensate is not just water loss, but you are also losing on the water treatment that went into the water and also the heat energy that's put into this condensate for in the boiler itself. So, it is an expensive resource and you want to, like, make sure you return as much of it back to the boiler house.

The third one I have is installing a condensing economizer for flue gas. So, this is a capital intensive project. What a condensing economizer does is very similar to a typical, sensible heat economizer which just captures the excess heat from flue gases. The condensing economizer takes it one step further and kind of captures the latent heat associated with that as well, and in that process, some of the waterway is also recovered, saving on water.

The fourth one I have is, again, checking, preparing, and replacing steam traps. So, both the third and the fourth opportunities, they are going, most of the savings is going to be coming from the energy side, but also, they have savings on the water side as well.

The last one, again, is with respect to reusing blowdown and condensate water. Reusing blowdown—some of the barriers we spoke about for cooling tower blowdown also applies, because again, this is going to be high conductivity water. With respect to condensate, definitely, the first thing you want to take a look at is making sure you're able to return it back to the boiler house, right? And in cases when you're not able to do it economically or there are logistic barriers to returning it back to the boiler, then you can think about reusing the condensate water for some of your other purposes, right? So, again, this is warm water, so, there is some low grade heat available in that as well, so you can think about using it in some of your processes or for your cleaning operations.

The next set of slide I have is on process water use and finding opportunities in them. So, process water use, I'm defining it as not just water use for fabrication or processing, also for cleaning, washing, or rinsing of the products going through your production lines, right?

So, typically, process water is gonna be the lion’s share of water consumed in your manufacturing process and hence, looking at it is going to be critical for facility level water optimization.

Some of the opportunities you can take a look at, the first one I have is process equipment modification, and this could range from simple, minor design tweaks that you could make to your equipment to kind of like a fully blown redesign of your equipment and production lines for water optimization, right? So, some of the simple things that you could start thinking about—for example, if you are using water nozzles for cleaning the product coming through, you can think about optimizing the number of nozzles, right, or maybe using a low flow water nozzle to achieve the same amount of cleaning required. Maybe you're using a water bath or chemical baths in your production lines through which the product flows through. In those cases, you can see, can you add in extra panels to optimize the splash out and reduce it is something that you can think about.

Again, process equipment is gonna be unique to each manufacturing process, too. So, the way you want to go about it is, think about how water is used in the manufacturing process, what is needed, and come up with design modifications, right?

The second one I have is improved production and operation planning. Again, these could be a set of opportunities that vary across the board in terms of complexity and implementation difficulty, but some of the simple things that you could think through to get started is with respect to how the cleaning shifts are done or how the maintenance is done, right? So, if, again, going back to the water and chemical bath, usually the water in those are dumped on a regular basis. So, thinking through how that dumping is done, what is the operation process in place and can you optimize it is something that you can think through. In a lot of cases, these things are put in place with mostly production in mind, and just like revisiting them from the perspective of water optimization is a good place to start.

The third one I have is installing automated control valves. So, these could be made use of for your production lines to make sure the water lines are cut off whenever production is not there or whenever it is not needed to kinda like take out the component of human error in these equipments.

The fourth one is specific to washing. So, if you have washing operations in your facility, there is a lot of different technique to conserve water in manufacturing washing operations using counter current rinsing setups, making sure you're recycling the water within the different baths before throwing it out, so some of those things can be considered.

The last one I have is, again, coming back to reuse and recycling, and this is going to be—recycling and reusing is going to be very impactful from the perspective of process equipment, because again, a lot of water is gonna be used in these cases, right? So, whenever possible, you want to reuse the water that is coming out of the production lines in other ways as deemed fit. So, in some cases, it might not be possible because there might be a lot of contaminants, the water could be coming in contact with the product, and there could be contaminants in the water itself, and even in those cases, though, you could still think about recycling it, and these projects could make sense, given the volume of water coming out of your process equipment and also if you start thinking in terms of the true cost components, right? So, those are definitely opportunities that you could look at for process equipment.

So, we are at the last leg of our webinar, and I'm gonna be talking about some of the DoE resources that are available out there for you to make use of. So, I'm gonna be going through this one by one. I'm actually gonna be talking much in department into Plant Water Profiling Tool and the Better Plants INPLT Training that we have, but I wanted to start off with the DoE’s Water Management Strategy document.

So, this is a document that was put together by the Better Plants Better Buildings program based on the Water Savings Pilot that was run. So, a couple of years back, when Better Plants, Better Buildings started the water initiative, we worked with a handful of companies, worked with them closely to find what are the barriers that they are coming across in terms of water management and what are the best practices that could be shared from them across the industries. And we put together this document as kind of the lessons learned out of that pilot, pretty much to help partners out to get started on their manufacturing—on water efficiency in manufacturing.

So, this document is available on the Better Plants Solution Center for you to make use of, and also in the Solutions Center are also some of the showcase projects specifically on water that you will be able to take a look at to see what other manufacturers are doing in this area of water efficiency.

The second one I have is the Plant Water Profiler tool, the PWP. So, it is a free Excel based tool developed by the Department of Energy, and it helps systematically determine the baseline water use and the true cost, right? So, the three steps that we spoke about—baselining water usage, finding the true cost, and identifying opportunities. So, the Plant Water Profiler tool kind of goes through all those three steps in a systematic way. It streamlines the data collection required for baselining, and also provides a good summary of reports and high level recommendations.

So, I just wanted to take a couple minutes to talk a little bit more in depth about the tool because I think that will be helpful, and maybe after the call, you can download it, take a look at it, and reach out to us if you have any questions.

So, the tool is broken down into 10 inputs tabs and a results tab, right? So, I have the first 8 input tabs here that I wanted to go through and I'll get to the 9 and 10 later on. So, the first tab is plant information, you just need to provide the background information for the facility, the address, contact info, some of the systems present in the facilities, so on and so forth.

So, tabs 2, 3, and 4 marked in orange here are to do with the inputs for doing the baselining for your facility, right? So, some of the information that you will be providing on these tabs are associated with water intake and waste water discharge—so, at the facility level and also at the system level, right? At the system level, what is the water intake into the system, its losses, so on and so forth.

So, the tool itself has built in calculators that you can make use of to make an estimate for system level water usage. So, in case you don’t have meter data, you can rely on these engineering estimates to do your water balancing and baselining.

So, that’s tabs 2, 3, and 4. So, tabs 5, 6, 7, and 8 marked in green are to do with finding the true cost of water at your facility, right? So, some of the inputs that you would be putting in into these tabs are, say, the unit cost of the water and also unit cost for the water treatment, right? So, say, if you have an RO process in your facility, what is the cost per treating 1,000 gallons of water through your RO system? So, things like that—similarly for chemical treatments, so on and so forth.

So, in addition to giving it these unit costs, you will also allocate how much of the water that you're using in your system goes through these water treatment processes and so on and so forth, right? And similarly, you will also be providing pump and mortar specifications for it to kind of calculate those embodied energy associated with pumping and water heating, et cetera.

So, once you're done with these inputs, at least on the first eight tabs, you will pretty much be done with baselining water use and true cost. So, tabs 9 and 10 are sort of more like a checklist that helps you identify water efficiency opportunities, but the majority of the results for the tool comes from these eight steps. So, once you're done with it, you can go to the results tab and take a look at some of the results that are generated and some of the summaries that are associated with baselining the true cost. As is mentioned, there are also a number of system based checklists that are available as part of the tool and those are available in tabs 9 and 10 that you can make use of that kinda like helps you get started in kinda like asking the right questions and trying to brainstorm about some of the opportunities that are available out there in your facility.

So, this slide just gives a snapshot of some of the highlights from the results tab. So, the graph on the top talks about the true cost of water, and as you can see, the tool provides for each system, for each process that you have defined, each group, what is the true cost of water being used in these systems, right? And it further breaks it down into its cost competence—like, say, for process one, how much of it is coming from municipal water intake, how much is from water treatment, how much has been towards wastewater treatment, so on and so forth. And, of course, water intake by system, it provides graphs for that. And similarly, the bottom right kind of talks about the benchmarking, right?

So, for each, it does it on a facility level and also on a process level, and it is based on the data that we spoke about from the Canadian manufacturer, right? So, tying it back to the data set that we spoke about at the start of the webinar, the tool kinda like has it as the back end as a database and the data that you inputted kinda like benchmarks it against your facility against that data set, to give you sort of like a quick comparison.

So that's the PWP tool and its various features. I would love to go much in depth into it. Actually, I wanted to see if I'm able to put together a quick demo, but given our constraints on time, I'm not able to do it. But feel free to take a look at it and reach out to us if you have any questions.

So, moving on, the next resource I have here is the Better Plants Water INPLT training itself. So, most of you are Better Plants partners and you are aware of the INPLT training available through the program, right? So, that is one of our flagship offerings. It's a two and a half day event that we have at your facility and we cover various different topics. So, one of the newest INPLT trainings that we rolled out, we just rolled it out this year, is the one on water efficiency for manufacturing, and it kind of covers most of these topics that we spoke about, like water baselining, true cost of water, and identifying opportunities in the system. So, just like any other INPLT trainings, the goal for the training is twofold—one, we definitely want to train folks on finding opportunities in water systems and also doing the baselining and true cost analysis, and at the same time, we are there at your facility, so we want to identify some of those water savings opportunities. So, we try to kind of hit both of those things as part of the event.

So, day one, we go through the exercise of creating the baseline water usage for your facility and identifying the true cost while the second day and the third day kind of is spent on identifying opportunities, putting a savings number on it, and presenting it to management.

So, just to give a little bit of a feel for the INPLT training process itself, of course, the training itself is over two and a half days, but we do start the planning process well in advance, a couple months in advance where we reach out to the facilities and kinda get a feel for the water using systems in there, try to see what is the data available, understand their water usage, evaluate if we need to put in data loggers—if so, we install them, collect more data, so on and so forth before getting everything set up for the training day itself.

So, even before we rolled it out to all Better Plants partners earlier this year, we piloted the Water Efficiency INPLT training with three of our partners, so, we worked with ArcelorMittal, Owens Corning, and Saint Gobain to host these events at their facility. And this table kinda gives a snapshot, a high level overview of these events, and I have kind of like summarized some of the key lessons learned from these events and also working with some of our other partners in some of the upcoming slides as well.

So, the first point I have here for the lessons learned from the field is, with respect to, specifically with respect to doing the water balance and making use of the PWP tool, right? And that is to group sources of water with similar intake sources and discharge outlets together. And what this does, it simplifies our data collection and our water balancing. So, in this example schematic that you see here—so, we have a process water lines 1 to 5 that uses RO water ad process lines 6 to 10 that don’t, right? And in this case, what we could do is, we could group these process lines 1 to 5 together and similarly, for process line 6 to 10, and we could perform data collection or estimation on them together, and this kind of like helps with streamlining our data collection and also for water balancing.

So, the one caveat here is, of course, we won’t have resolution into specific production lines, but if you need that kind of information, then obviously, you can group it together. But again, if you're starting off building these models and water mapping, then definitely, you can start simple and build it from there.

So, the second lesson learned here, I have here is, of course, doing sort of an exercise of putting a schematic water flow diagram together, right? So, most facilities have their pumping diagram for water flows, but again, it's very convoluted, and it's probably not an effective way to understand your water system or get the message across, right? So, putting a schematic, something simple like the one shown definitely helps in understanding our water flows better.

So, another one I have here is with respect to the lack of metering and submetering in place for system level water usages. So, typically, what we find in the field is, like, a permanent submeter is not in place for system water usage. So, one way you could go around it is by using short term monitoring like using non-intrusive ultrasonic flow meters to data log system water usages and kind of extrapolated for consumption.

One caveat to note here is, definitely, ultrasonic flow meters are really good to work with and they do give good, accurate measurements, but finding the right location for them could be a little tricky. So, they have specific criteria that you need to hit for them to work properly, like, they shouldn't be close to your elbow bends, and of course, the water flowing through the tube should be clear and at the same time fully formed for them to get accurate measurements. So, those are things that you want to make note of when making use of these equipments.

Another lesson learned I have here is with respect to water infiltration and precipitation. And this could really make it difficult to do water balancing—so, water infiltration and precipitation associated with drainfalls or infiltration associated with other groundwater sources. So, these could get mixed in, into your water lines before the discharge or somewhere along the lines, and it could really throw off your water balance, because when you have a waterline coming in, for example, say, if there is a lot of infiltration right outside process lines 1 to 5, right, then it really throws off your numbers that you're calculating upstream, and it could really make the water balancing difficult to do.

So, moving along with some of the other lessons from the field that we have—so, individual system level discharges could be difficult and it is much easier, of course, to get water readings on the intake side than the discharges, right? Say, for example, in this case here in the bottom left picture, it shows a hot mill rolling operation, so we have our hot product going in through our product line where water is used to cool it, and we see water being drained off into the lower level of the facility, right? And in this case, it’s—probably from there, it goes off through a channel via gravity through the outlet and discharge. So, it’s gonna be hard, and in some cases, it could be underground as well, and it could be hard to really get a good measurement on it, or even put a meter on it to measure it, because of just how, the way the water flows are set up, right?

So, that could be a hiccup that you could come across when trying to measure the discharge flow from individual systems.

So, the last point I have here is with respect to behavior driven water consumption—say, for example, in the case of, like, open spring, they could significantly change with the shift, because it’s totally gonna be dependent on the people using it and in order to accurately estimate it over a period of time, you need to data log it to make sure you're capturing it across shift and over multiple days so that you get a good average. And just a single time snapshot measurement is not a good measure of behavioral driven water consumption uses.

So, those are some of the lessons we have learned from working with some of the manufacturing companies. So, moving on to the last resource I have from DoE and that I wanted to share with you is with respect to the diagnostic equipment loan program. So, we spoke a lot about data collection and the need for it to kinda like do the baselining and identifying the true cost of water. So, some of the tools that we had made use of in the field during our implant trainings, we are making it everybody for our Better Plants partners to use when we are not having the INPLT trainings, right? So, again, this is completely free for Better Plants partners to use, it comes with a return label, and we do have some of the equipment that I spoke about, like the ultrasonic flow meters for water flow readings and we even have the conductivity meter if you want to take a look at your cycles of concentration in your boilers and cooling towers and so on and so forth.

So, yeah, if you are interested, definitely get in touch with us. Your tabs will also be a great resource to know more about the equipments that are available and how you could make use of this.

So, with that, we have come to the end of our webinar. I hope it was informative. If there are any questions, definitely type it in, in the comment box, or you can raise your hands digitally.

Eli Levine: Thanks, Kiran. So, yeah, by all means, everyone use the chat box or raise your hand to indicate a question and we're happy to take some now.

Kiran Thirumaran: So, I did see a few questions come in with respect to making the presentations available. So, the slides, the recording, and also the transcript, all of them will be uploaded to the Better Plants Solutions in the site. So, the same link that you used for registering for these webinars, you will be able to find those files there for you to make use of.

So, again, feel free to make use of the chat box to put in your questions, or at the same time, you can also digitally raise your hands and we can unmute your lines to take in questions, right.

So, one of the questions I have here is with respect to cycles of concentration for cooling towers—is there a good range defined, right? And as we've been through it, it’s gonna be dependent on the water quality going in, so it’s gonna be dependent on what kind of water treatment you have beforehand. I've seen cooling towers going up to 6 to 7, so that would be the high range that you can aim for—but again, anywhere in the 4 to 6 range is a good number, and anywhere below, then you really need to think through why it is there, right? It is not that if you have 3, then it’s a bad cycle of concentration, as long as you're able to justify why you're having that number, right, but 4 to 6 is a good range to go for.

So, the follow up to that was—we are having a range of 10 to 11 in South Carolina and if it could be because of weather conditions. So, cycles of concentration is not gonna depend on weather condition, it’s probably because of the water quality. Again, 10 to 11 seems to me like a range that boilers usually operate in. If you're actually having a cooling tower that’s operating at 10 to 11 and actually it is, like, really great, it’s probably something, you have a really quality of water. And as long as your conductivity is maintained within the range and you are able to maintain 10 to 11, then that’s something great.

Alright. So, another question I have here is—does your tool also model compressor systems with quality of condensate blowdown included? So, the PWP tool that we specifically spoke about is kinda like a water footprint tool for your entire facility, right? And as such, it doesn’t go into specific systems, like say, compressors or things like that, but we do have a separate tool for compressors and condensate form and removing condensate from compressors as a part of the measure. So, it is not part of the PWP module.

Alright. So, we have a few more questions come in. What is a good recovery range for condensate return? So, typical range you would see is 60 to 80 percent, right? But we do see even higher condensate written, being written from the boiler and the higher you are able to go, the better, right? Some facilities are able to hit even the high 90s. So, anywhere from 60 to 90 percent is a good number to target—and again, it's completely gonna be dependent on the size of your facility, the kind of processes you have in the facility, because again, remember, some of these steam losses could be associated with the process itself, right? And in those cases, it would probably be not possible to return that set of condensate. So, it is gonna be depend on your size of the facility and the processes that you have over there.

Alright. I'm also having a couple more questions here that I'll try to get to, but if you need to drop off, I know it is right at the 2:00 hour—if you need to drop off, thanks a lot for joining our call. I'll try to hit on some of these last few questions before we wrap up.

So, are there metric standards established already for different industries? So, I'm assuming that question is based on water intensities. So, as of now, we don't have a benchmark metric for different industries, right? A few industries might have their own internal metrics that we use for it. As part of the Better Plants Water Initiative, that's something that we try to do, kind of like have a water metric that we want to track, right, but even in that, there is a flexibility in that, we understand it is gonna be dependent on your organization what metrics you wanna track as part of your water performance. So, the Better Plants program does provide flexibility for setting up metrics.

Alright. So, one last question before we wrap up is, with respect to the PWP tool I have and if there is an effort in place to creating PWP tools specific for industries, right? So, that is something that we are looking at, so, the PWP tool right now we have is very generic in the sense it could be used by all manufacturers and it is designed as a holistic tool. But we are looking at, we are working with auto manufacturers and looking at other industries as well to see if the PWP tool can be tailored specific to water consumption in specific facilities and kind of build calculators that are more process specific, right, for that particular industry to estimate it. So, that is something that we are looking at and we are looking to work on in the next couple of months.

So, yeah, with that, Eli, I wanted to turn it over to you to see if there are any other final thoughts you had.

Eli Levine: Wonderful. No, Kiran, I thought you did an excellent job and you have Kiran's information there if you have any questions for Kiran as well as all of my contact information and different ways to contact us.

Just a reminder that we wish you to sign up for the Better Buildings, Better Plants Summit, which is coming up in a few weeks. I think that if you like this content, you'll really like what we're covering at the Better Buildings, Better Plants Summit and, by all means, send us your suggestions for future webinars when we're able to restart the second round of this webinar series, and otherwise, just thank you for all of your participation in these and just a reminder to stay safe out there if you enjoy this coming holiday weekend. So, thanks, everyone.

[End of Audio]