**Pre-In-Plant Training Webinar: Water/Wastewater at OWASA – Dawn Lesley**

*Interviewer:* Well, good afternoon, everyone. Welcome to the Better Plants Pre-Inplant Wastewater Webinar, getting us ready for a training coming up at OWASA, in May. We're very excited to present this training. This webinar is kind of an opportunity to get us all on the same page, getting ready moving forward. I guess I'll start by thanking the US Department of Energy and their Better Plants program, which in a minute we're gonna describe in some detail. And also wanna thank OWASA for taking the plunge of hosting this training coming up in May; very excited to be coming out there to visit and work with OWASA and the other participating plants that will be coming to the site for that training. Today, on the line as trainers, we're gonna have me; I'm Dawn Lesley, and I work with Cascade Energy. And Lane McWilliams is also on the line, from Cascade Energy. And we also have Peter Narbaitz, from ICS, who is gonna present, today. And I just kind of wanted to point out that, when we're at the plant, we'll be joined in day two and three by Eric Wahlberg, who's with Wastewater Technology Trainers.  
  
And just to give you a sense of what's coming in this webinar presentation, today, definitely wanna welcome all of you, and have Peter talk about the Better Plants program. We will have some time – I wanna hear who's on the line, and find out something about who you are and what your role is, and what your expectations are for the INPLT training when it comes up. And then these other topics, we'll go through, in this Webinar, talk about the topics you see listed there on the overview. So with that, I think I will turn it over to Peter, and he can maybe introduce us to what is this thing called INPLT trainings.

*Peter Narbaitz:* Yeah, that sounds great. So, first of all, my name is Peter Narbaitz, and I work for a company called ICF, and I am the technical account manager for OWASA in the Better Plants program. And so, I work on behalf of the Department of Energy, to help OWASA in this program. So, we're here, today, to talk in this Pre-Inplant webinar, about the exciting training opportunity that's taking place in the first week of May. So we're gonna be doing a training session, obviously focused on water and wastewater treatment, so today's webinar is to discuss those topics, and energy efficiency in the water and wastewater sector. But also to give a bit of a heads-up and overview to everyone who's gonna be attending those training sessions, so kind of a two-part strategy, today. So, yeah, we wanna really get ready for the exciting training sessions in the first week of May, and we have some great experts here from Cascade, to really lead that discussion.   
  
So, if we can go to the next slide, then?   
  
Just, a quick, introduction, then, to the Better Plants program. Some of the attendees on this Webinar will be part of the program already and know about it, but if you're not familiar with it, it's a voluntary initiative to help drive energy efficiency in US manufacturers. So, typically, we are getting companies that sign up to commit to a voluntary target of improving their energy intensity by 25 percent in 10 years, and we have more than 180 companies signed up for the program, throughout the US. So, it's really focused on helping make manufacturing more competitive, and the DOE tries to support all companies that sign up, through a variety of benefits, whether it's recognition for all the efforts they're making, and technical support in different ways. So, this INPLT training is one of those opportunities to provide technical assistance to Better Plants partners, and if there are other Better Plants partners than OWASA listening in today, you know, this type of training session could be an option for you going forward.  
  
And actually, we're currently in a period, or the twice-a-year period, where the sign-up period is open for these INPLT training sessions. And so, if you wanna have some DOE experts come to train the folks at your facilities to help identify and implement more energy efficiency projects, that's what this is all about.  
  
So, we'll go the next slide.  
  
We'll talk a little bit about what is an INPLT training session. So, really, there's two main parts to it: we're really focusing on having some time in the plant with hands-on training, supplemented by some time in the classroom, where we are going through a lot of the key basics and understanding what do you need to know to identify and quantify some of these opportunities.   
  
So, if you click again here, there's another piece of the slide that'll come up.  
  
So, you know, this is all about really trying to provide the tools to succeed and improve energy intensity, and one of the things that we've found is, beyond just the training and the assessment itself that takes place, it really helps to bring together participants from different plants and different organizations, to drive energy efficiency in the long-term. So that, if we can get multiple utilities from throughout North Carolina to come to the OWASA training, we can have a broader pool of minds at the table, helping identify opportunities and sharing opportunities that can be replicated everywhere. So, you know, we're really hoping to have more utilities able to join at the training session.  
  
If we go to the next slide, then?  
  
So, what do some of the key elements of the INPLT model? So, here we're listing some things. First off, we have, you know, identifying energy savings opportunities. You know, this is really critical; we want to be performing an assessment while we're on the site, to try and find some opportunities that we can add to OWASA's energy management plan, and can be considered going forward towards your targets. We also wanna provide networking opportunities, so again, building those links with other partners, to help drive a sustainable framework for energy efficiency. You know, we wanna talk about project implementation, and really focus on getting through some of the barriers that might stop energy efficiency. Again, we wanna talk about what some of the other resources might be, whether it's utility programs, or state support, and learning from your peers. And then finally, we really wanna get our hands dirty in a real-world environment, where we can learn in a way that makes sense and really resonates with everybody involved in the training, so, you know, we're gonna get out in the plant.  
  
And we some photos, here, about these two components. We're really gonna be spending time in the classroom, you know, presenting the fundamentals in a way that can be easily understood by everyone involved. But also, we wanna get out into the plant and really learn how to measure and implement and identify these opportunities. And Dawn and her team are really a great people to be leading that. Just one more plug, then, for the different types of INPLT trainings we have. You know, we see, here, that we're gonna be doing a wastewater and water treatment-focused one. We also have pumping INPLT trainings, there are treasure hunt exchanges, fans – so, we always try and focus on one type of system, so that there's enough time to really dive into things. But we try to have about 10 to 15 of these training sessions every year, throughout the country, and there are always opportunities to attend training sessions at other sites, if anyone's interested.   
  
And just gonna go through a little bit of a brief look at the agenda, so, there's potentially a couple spots left, if anyone listening in from another organization is interested in attending the training starting on May 1st. But for all of you who will be attending, this gives a little bit of an overview. So, the first three days are gonna be in the wastewater treatment plant, and the fourth day is gonna be in the water plant. So, that's how that split is gonna happen. We're roughly gonna be going 8:30 to 4:00, everyday, with a break for lunch, and focusing, everyday, on a bit of the energy basic, but also on some specific areas of the plant to drive in to real detail. And finally, before we turn it over, just wanna talk a little bit about Dawn, you know, she's a really experienced engineer in this area, and so, she's involved in utility programs in the Northwest, related to water treatment. And she has more than 20 years' experience in the water and wastewater sector, so she's working a variety of different roles throughout the sector, whether it's planning or supporting infrastructure projects.   
  
And she teaches a lot of these courses already, so she's really honed her message in what works and doesn't work in these training environments. So, we're really happy to have Cascade and Dawn's team onboard, and looking forward to the rest of this webinar, and especially the training session coming up. So, if you have any other questions for me, you can reach out, or reach out to Dawn, and, yeah, look forward to the rest of today's presentation.

*Interviewer:* Great, thanks, Peter. So, I do wanna make some time, at this point, to have introductions of folks on the call, and I think I'll start with Lane McWilliams. Lane, if you wanna – he's my partner in crime at Cascade; we work together mostly on – to date, we've worked on energy and energy efficiency at water and wastewater plants throughout especially the Pacific Northwest, but that has been growing across the country. And so, Lane, if you wanted to say a few words to introduce yourself?

*Lane:* Sure \_\_\_\_\_ \_\_\_\_\_ can you hear me?

*Interviewer:* Yup, I can hear you.

*Lane:* Okay, great. Yeah, so thanks for joining, folks, and I'm excited about this program. We at Cascade, we've been sort of focused on these energy efficiency opportunities in water and wastewater, now, just specifically since 2010, that's all we've worried about. And I just got back late – well, I guess, early this morning – from a trip to Colorado, where I was working with Boulder and Greeley. Both of those facilities have done tons of energy work, but you know what, even during that day, we found 5 percent at one plant, and probably 11 percent at the other, just by taking a new look at what they're already doing. So, that's kind of what we're hoping to help you folks do, through this training. And Dawn will be your trainer; I'm going to Phoenix, the week before. Then we're gonna combine our notes, and we're gonna do another one here this summer. So, looking forward to it and – I'll get off the phone, now, sorry.

*Interviewer:* Okay. *[Laughs]* Don't go too far. So, maybe we'll start with Mary Tiger's group. I started to unmute everybody, and then I realized there was some background noise, so, I think – Mary, are you able to hear me, and maybe able to introduce who's there with you?

*Mary Tiger:* Yes, sure can – can you hear us?

*Interviewer:* Yep.

*Mary Tiger:* Okay, I'll start, and \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_ the roundtable. I'm Mary Tiger; I'm the sustainability manager for OWASA, and kind of the primary contact with Peter and with Dawn, so far, so –

*Adam Haggerty:* I'm Adam Haggerty; I'm in the engineering department, and I am the asset management facility's engineer, and *[audio cuts out]*.

*Mary Tiger:* Also a member of the energy team. *[Laughs]*

*Adam Haggerty:* Oh, and a member of the energy team, yes.

*Pat David:* I'm Pat Davis, and I help Mary and others on the team here, on a variety of projects, working on, like, a two-day-a-week basis.

*Kenneth Laughlan:* Kenneth Laughlan – I'm the water supply and treatment manager for OWASA; run the water treatment facility \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_.

*Mary Tiger:* And then, we have a colleague that's out in the hallway on the phone right now, who's walking in, and his name is Eric Oldam, and he's the maintenance supervisor, manager – maintenance supervisor for the water treatment plant. And then Todd Taylor, the director of operations, is in and out, here, as well. And we have some of our staff that is at the wastewater treatment plant, and they're signed on, as well. I'm not sure if *[audio cuts out]* able to *[audio cuts out]* talk to you *[audio cuts out]*.

*Interviewer:* I see names, so I'll just maybe – so that's who's in the room with you, Mary?

*Mary Tiger:* That's who's in the room here, yes.

*Interviewer:* Okay, so I'll just run through who I see on – I see a Jonathan Walker signed in, so I'll unmute you, Jonathan, and –

*Jonathan Walker:* Yeah, can you hear me?

*Interviewer:* Yup, I can hear you.

*Jonathan Walker:* Yeah, I'm actually working from home, today, so, hopefully everything stays connected. I'm with Charleston Water, down in Charleston, South Carolina, and I've been talking with our engineer about possibly attending your INPLT training program up there; it's kind of the closest one that you all have set up. So, currently, I'm the director of the wastewater treatment plant down for the city of Charleston. So, we've signed up for the Better Plants program, and we're looking forward to kind of getting involved in some of the initiatives and stuff that are out there. So, again, just kind of here listening to the preamble to the training, and hopefully I can make it up.

*Interviewer:* Great, that's great to hear – welcome, Charleston. Next, I see a John Cubaneme – if I butchered that name, I apologize.

*John:* No, you actually did very well. I'm the wastewater *[audio cuts out]* manager for OWASA.

*Interviewer:* Okay, great, thanks, John. And then I see a Jennifer Travis. I'm not sure, but I don't hear anything, so, Jennifer, if your mute's on, you can unmute. Otherwise, I think we'll just move on – I see Kaitlyn Numador. So I'm not hearing a person there. And then I see an Andrew, but I'm able to unmute that. \_\_\_\_\_ \_\_\_\_\_ do a quick test. Mary, can you hear me?

*Mary Tiger:* Yes, we can hear you.

*Interviewer:* Okay, so, there were some other folks listed, but I guess we'll just move on in slides, because if I unmute everybody, it starts to get loud, and I didn't hear from individuals. But great, welcome to all of you who are here; glad to have OWASA so well represented on the water side, on the wastewater side, and also maintenance and operations. Really glad that, Charleston, you're taking the plunge to join us here, and hopefully at the INPLT training in May. And maybe let's just move into the slides, the rest of the slides, the rest of the content. So I wanted to start with a little kind of grounding in this concept of the water energy nexus that we here talked about. Really, can there be any doubt that there is power in water? I mean, any of us who've spent any time around large water bodies, it's pretty clear that water and power are connected.   
  
But historically, we have really siloed these topics, and so, we come upon what – we talk about the water-energy nexus as if it's this new thing, and we have things, you know, reports that are issued to remind us of how they're related. And we even do really fancy looks at the ways that they're related, but I sort of, I chuckle when I see some of this. I think it's great, I think it's great that we can analyze this and remind ourselves that energy – there's water used to produce and distribute energy, and there's energy used to produce and distribute water. And so here is this wonderful infographic of an analysis that was done by the DOE, to sort of illustrate what that really means. But anybody who's stood next to a big waterfall knows that, you know, this isn't a new idea – it's just new that we're thinking about it and analyzing it in this way. In the water and wastewater industry, we really have some challenges in connecting and in unsiloing these concepts. I mean, we already have the issue that we silo water and wastewater separate from each other, right?   
  
And that's already – seems to be kind of one of the things that humans do, is look at things sort of one thing at a time, even though they're so obviously connected. You know, I kind of wanna point out that the whole reason we have water and wastewater industries would be to protect human health, to start with. You know, for most of human history, we simply drank the water and avoided fouling our nest, and back in early history, what that meant was, you know, you walk away from camp to do your business. And as populations grew, it became harder to do this: clean water sources became fouled by human activity, and waterborne diseases began to proliferate. And so, we started by saying, "We have to do something about our water, in order to protect human health." And then right behind that, later, we had to start thinking about the second purpose, which is: protecting the environment.   
  
You know, the Cuyahoga River is famous for having caught fire *[laughs]*, and that kind of put us on notice that it is kind of important not just only to protect human health, but that we have an environment that we depend on, and so we have to think about this aspect. And so, we started adding this purpose to water and wastewater industry, and it became an industry. But no one really asked us, in the early days of water and wastewater, no one asked us how much energy it would take; solutions were implemented without any regard for how much energy they would use. And I think it really goes back to an early idea that, you know, in the implementation of the national energy industry, we had even songs written about how energy is gonna be too cheap to meter – that was the sort of marching orders of the energy industry. And so, if energy is too cheap to meter, and it never really makes it on to the docket of water and wastewater – we silo those ideas and have historically siloed those ideas.  
  
So that's kind of the backstory, and now, what drives us in the water and wastewater industry, obviously, is regulations, and safety, and environmental ethic. Every plant I've ever been to has those priorities, and they're good priorities and they are the right priorities. And I also think there's an element of maybe our industry suffers from kind of a basic shyness, you know, we are invisible in most of our communicates, and we generally like to keep it that way. And for most people at water and wastewater plants, the worst day is the day that you end up on the frontpage of the paper. *[Laughs]* So we really try to stay out of the limelight, and that means that we are good news-bad news, right? I mean, we're invisible – there's some good things about that, but there's also some challenges with that. So when we get into this topic of reducing energy used, these are the ways that we can do it. Water is heavy, so it takes a lot of energy to move it.  
  
And so, when we look at how to improve energy performance – which is a term that I'll be talking about in this training – these are the ways we can reduce the energy used to move water, is we can take advantage of gravity whenever possible, we can reduce the amount of water we pump, so there's a water conservation aspect to energy efficiency, in water and wastewater. And we can also increase the efficiency with which we pump it, getting into the equipment and some other issues related to pumping. And then, of course, there's the treatment – we treat water, we treat wastewater, and if we can reduce the amount of energy we use to do that, that's another way to get at it. So, reducing the amount of water we treat, and increasing the efficiency with which we treat it – pretty much most, if not all, of the topics that we'll talk about in the training come down to these elements. In our industry, these are the trends, right? The budgets are – essentially, costs and rates have a lot of pressures on them increasing our budgets, because of permits getting stricter, infrastructure aging, weather events getting more unpredictable and extreme, and then costs increasing.   
  
So all of those things are pressures exerting – upward pressures, you know, pressures that are trying to, and successfully, increasing our costs, which of course results in increasing our rates. And I only know of one superpower that is exerting a downward pressure on costs and rates, and that is, operators getting smarter and better at what we do. And that's what we're about in this program. So, we still are gonna be protecting human health and the environment, just as strongly and carefully and effectively as we always have been. And we also are gonna be continuing to protect operator safety and emphasizing crisis-free smooth operation. And what I'm gonna suggest to you, what this program will be suggesting to you, is that now we can also add minimizing energy use, as a way to exert a downward pressure on costs and rates. Because historically, without that, without having imbedded energy consciousness and energy awareness into our facilities in the past, there are opportunities in all of our facilities.   
  
And in our experience, these are not priorities are not in conflict with each other, in fact, the plants that we've worked with that really get onboard with energy efficiency actually end up getting better results on all of the other priorities that we've always had. Are there any questions out there – let's see, I guess I'll unmute the folks who have – do some unmuting – how are we doing, out there? I feel like it's very, very quiet, which is sort of how this works, but I just wanna check – are we doing okay, out there? Any questions, so far?

*Mary Tiger:* We don't have any questions, but it all seems very relevant, especially *[audio cuts out]* we were recently on the frontpage *[crosstalk]*.

*Interviewer:* Oh, no, that was a bad day, right? *[Laughs]*

*Mary Tiger: [Audio cuts out]* bad days. *[Laughs]*

*Interviewer:* Darn it, darn it, okay. So, going forward, you know, meanwhile, nationally, population growth and demand growth continue, you know, where will we get tomorrow's power. So I kind of wanna bring this into the energy context a little bit, you know, why are we thinking about energy, not just in terms of reducing costs and reducing pressure on rates. We also have an energy perspective, going into the future, you know, all of the electric utilities and all of the energy providers and producers in the country have to look ahead at where tomorrow's energy is gonna come from, where tomorrow's power is gonna come from. And, you know, it's a challenge: Are we gonna build more dams? Are we gonna put in more nuclear plants? Are we gonna build more natural gas power plants or coal fire power plants? Are we gonna build more solar? Are we gonna build more wind? I mean, the answer is probably yes, to many or even all of these.   
  
But, of course, for every single one of those generation technologies, there are politics, and there are planning, and there are very, very large costs and massive budgets at play. So meanwhile, what we know is that what I'm gonna call megawatts – what the industry is calling megawatts – energy conservation is extremely cost-effective, in contrast to those other capacity solutions. The DOE has been investing in energy conservation for homes, and commercial properties, and industry, for many years, because it's just simply the most cost-effective source of energy to meet growing demand. So, doing effective energy conservation stretches the energy generation capacity that we've already built, and makes it all last longer and serve our needs longer into the future. So looking back at our industry, water industry, are we actually wasteful with energy? Well, it depends on how you look at it.   
  
As I've pointed out, energy efficiency was never historically a goal, and so, every plant has opportunities to increase efficiency. And in our work, we have seen facilities save 2 percent all the way up to 40 percent. We have also seen facilities save zero percent, but really, those are only the facilities that refuse to get onboard. So, getting at that question of are we wasteful, I wanna point out, here – I wanna take a minute to point out that there's really a big challenge in benchmarking. People wanna know, "Is my facility wasteful with energy? Does my facility have good energy performance or not?" And I would just want for us to consider that there's a very big benchmarking challenge: on the water side, what your water source is, and what your water quality is, and the particulars of your distribution system, will vary tremendously from site to site. If you've worked in more than one facility, you know very strongly that every single facility is extremely different, and all of these different factors strongly influence the energy picture and what kinds of energy, you know, performance is gonna be even possible.  
  
On the wastewater side, the terrain – how much of your system is gravity flow, and how much is pumped, what your equipment is, equipment that – you know, many facilities have been in operation for 20 years, or even 40 years, already, and so, what you have is what you have, you know? And your permit requirements are gonna vary from site to site, your biosolids disposal will definitely influence what kind of energy performance you're able to achieve. And so, for most plants, really, you can't compare one plant to the other, and the best benchmarking is gonna be against yourself. And where that starts, the first part of being able to benchmark against yourself is to know where you're starting from, and we're gonna talk about that in a bit. So does this stuff really work? Well, I'm gonna give you a couple of examples. Kind of like Washington wastewater treatment plant, with a 5-milion-gallon-a-day average annual flow, were saved 1 million kilowatt hours in their first 7 months of working on it. So that's $54,000.00 and counting.  
  
In Boise, there's a wastewater plant that, in the first year, saved 17 percent of their electricity. Salt Lake City, a bigger plant, five mgd plant, that central valley plant hit *[audio cuts out]* they had said, going into an engagement that we did with them, that they wanted to save five percent, and they hit that five percent savings goal in the first nine months. And then there's a much smaller plant – they saved 12 percent, in the work that we did with them. And then here's a water plant, Logan, Utah, in the first year of looking at energy in an organized and committed way, saved 32 percent of their energy costs, in the first year. Now, all of these plants have implemented combinations of capital improvements, and operation and maintenance improvements. All of that comes to play in all of these plants – they're different opportunities, but they take sort of different strategies to implement, capital versus O&M, but they're all really, really valuable. We're gonna give you lots of ideas from our work, lots of different approaches to doing capital and O&M improvements.  
  
Here's an overview of the topics that we're gonna talk about in the four days, and you'll notice the first three days are wastewater. That's the way that the INPLT training is structured at this point, with an optional fourth day that OWASA has chosen to be a part of, as well, to focus specifically on water. There's certainly crossover in all of the topics, for instance, every single day, we're gonna start with energy basics, just because that's such an important part of this. Learning a new language takes repeated exposure *[laughs]* to the vocabulary and the tools of that new language, and I would encourage us to think about energy as kind of a new language. And so, everyday, we start with energy basics, and that will be applicable to water and wastewater, every single day. Wastewater facilities are often more energy intensive than water facilities, because of the additional treatment that tends to occur there. Again, you can't say always, but generally-speaking.  
  
So you'll see lots of topics there, in water and wastewater, but of course, we have the longer agenda on wastewater, because of the \_\_\_\_\_ \_\_\_\_\_ complexity of it, typically. We do start every day with energy basics. Energy is a language that we don't often speak in the water industry. Every person at the plant, in my experience, tends to know how to speak in gallons-per-minute, and million-gallons-per-day. If you ask the average staff member at a plant what is the flow today, they almost always can tell you what the flow even is today. They certainly know, in general, you know, winter, summer – they know lots of stuff about MGD, about gallons per minute; if they're on maintenance side, they know how many gallons per minute this pump pumps. But almost no one at the plant speaks the language of kilowatts and kilowatt hours. So, we're starting here, every morning, with practice in learning and using this language, because becoming more conversant in this language raises the overall energy intelligence quotient or the energy IQ of our facilities.  
  
And so, I'm talking with Mary, the other day, I was saying, you know, there's the upshot to having just about anybody in your staff participating in this program. Learning this language helps everybody get better, because that energy IQ is something that most plants just haven't historically focused on. We're gonna look at bills, and we're gonna work with bills – most plants don't see the bill; city hall gets the bill. And what does city hall do with this bill? They simply pay the bill. In fact, in most of the engagements where we work directly at the plants, and when we engage with facilities over a period of time, some of the work that we've done, say, we'll engage with a plant over a course of a year or two years, so we have the ability – unlike this, you know, this is kind of a short one where we're just with you for four days. But when we engage with a plant over time, we'll say say things, like, "Okay, before our next meeting, go talk to your electric utility or your gas utility, and get the bill, and find out what's on your bill."  
  
And so, the plant operator calls the city hall and says, "I need the bill," *[laughs]* and it turns out, city hall often doesn't even know which one of the 17 or 45 electric city line items are the plant. The bill will have really helpful things, like, just a meter number, or just "135 South Adams Street," and that's where the meter's located, but city hall often doesn't even know which part of the city's electric bill is the treatment plant. So, it turns out that, you know, part of why this is all invisible is just imbedded in that structure of how nobody at the plant ever sees the bill, and how they may not even know. So, once we have a perspective on how much electricity a facility uses, we need to take apart that bill in terms of the units of measure that are in it. And two basic units of measure are – essentially, most of the bill is based on two units of measure. One is kilowatts, which is the amount of stuff we have online right now, so kind of a – and you can relate that to horsepower; we'll talk about that in a minute, but – it's sort of demand versus consumption.   
  
Power is the demand that we're exerting, in a sort of a snapshot perspective, and then kilowatt hours is the total amount of energy we're using, over a particular amount of time. So, demand versus consumption, power versus energy, meters measure demand and consumption. And to save energy costs, we are concerned about reducing demand or power kilowatts, and also reducing consumption, or, the actual total energy used, which is kilowatt hours. In order to estimate power, we can estimate it from horsepower and load factor. So, an alternative definition for load factor is how hard the motor is working, and we then calculate how much power is being used by equipment, by knowing the motor horse power from the nameplate, and how hard the motor is working and the estimated capacity or the estimated load on the equipment, and then, the motor efficiency rating from the nameplate. So if we wanna estimate the power in a piece of equipment *[audio cuts out]* would need to know these things.   
  
And we can also estimate cost of operating some equipment, by knowing that power number, and then the hours of operation that something runs. So we're gonna take that power number that we got, and then we multiply by the number of hours it operates, to know how many kilowatt hours that equipment uses, and then we multiply by the rate. I don't know the rate at your facility specifically; we'll talk about that at the INPLT training when we're there, but we see rates across the country vary pretty tremendously, from 3 or 4 cents a kilowatt hour to in the Pacific Northwest in some places, all the way up to, I think parts of Hawaii, electric utilities charge even as much as 33 or 35 cents a kilowatt hour. So, knowing your rate and applying it to the number of kilowatt hours helps calculate that energy cost. On the gas side, we have a slightly different picture. On the gas side, we think of volume of gas and meters measured gas volume, but not the energy content of that volume.   
  
Every utility uses different measurements, but typically volume is involved, and also, some utilities charge based on energy rather than volume. Most of the end users are measured in Btus or horsepower, for boilers, and a Btu is the heat required to raise one pound of water one degree Fahrenheit. So, meters measure the volume, and then the utilities will charge on either a volume or an energy basis. So you'd have to look at your bill specifically, to know how your charges are structured at your facility. And then there's the volume to energy conversion: every cubic foot of gas will have 1.025 Btus. In order to estimate the rated input, for gas using equipment, the equipment will \_\_\_\_\_ at a certain amount of usage, and it would be displayed in a number of different units. So, Btus per hour, 1,000 Btus per hour, and then here's some helpful conversions. Horsepower – there's 33,465 Btus per hour, in horsepower; or you can convert to pound steam. So there's different kinds of units that get used to be able to estimate gas power.   
  
You get the rated input from the nameplate in one of these units, and you have to apply a load factor as well, just the same way we applied it for electricity-using equipment. When equipment is lightly loaded, that percent number is low, and if it's working really hard and at full capacity, you might have a load factor of 90 percent or 100 percent. \_\_\_\_\_ affect how fast and hard that equipment uses gas, so being able to estimate firm use from these kinds of things, we have to look at these factors in order to make these estimates: Btus per hour from the nameplate, a load factor, hours of operation. And that way we can get to energy cost, being able to estimate the energy cost, therms, calculate the therms, and if you know the rate, whether you're charged per therm or per *[laughs]* – I meant to turn that off – sorry about that – *[Brief silence]* So, that's how we estimate energy costs on the gas side, and then, coming into the – when we are –  
  
In the INPLT training, talking about energy efficiency measures, we will be talking about two kinds of measures, generally-speaking. Some energy efficiency measures are purely equipment measures, where we're replacing an inefficient motor with a more efficient one, or we're replacing a broken thermostat, or we're fixing air leaks or water leaks, reducing operating pressure where we don't need it. So some of them are just purely equipment measures, and some measures go to the heart of a process. So can we reduce the RAS rate is really, there's an equipment aspect to it, whether the equipment will allow us to do it, but first and foremost, there's a process question: "Can we reduce RAS rate?" has a big process implication. So we have to understand the process in order to know if that's a good measure or not. So, in the training, we'll be talking about equipment issues and process opportunities.  
  
And also, we encourage cheating, and we're gonna provide you with some cheat sheets that help you approach these questions. There's a wastewater energy efficiency cheat sheet that we'll be working with in the training, that give you top-ten lists, and give you some easy quick looks at some tables that help you quickly estimate what kinds of energy savings you can get by changing your DO levels at different temperatures. Lower pressure, so, there's a cheat sheet for wastewater, and there's also a cheat sheet for water energy efficiency, to help you quickly diagnose some typical energy efficiency opportunities that we see. We will spend some time with top-ten lists – again, this is sort of, we call it cheating, 'cause it feels like we're sort of taking you to the typical low-hanging fruit, if you will, or the typical easy places to look, to find energy savings opportunities, helping you minimize loads, using your best part load option. So, I guess to that loading factor question, you know, when equipment is underloaded, we tend to see it might not necessarily run as efficiently as we'd hope.   
  
Helping you figure out what you can turn off, or maybe turn off for some portion of the 24-hour period. How can you minimize pressure drops, optimize pressure settings, keep your idling time to a minimum, making sure you've got the right technology for a particular task you're trying to do. And helping you think about right sizing equipment, removing barriers to more efficient setpoints, and making the most of your controls. We're gonna get into specific aspects, you know, the process pieces of the facilities. So even though this is a tiny plant, this is a screen from a real tiny plant, but the concepts are the same, you know? Headworks are designed to remove trash and not organics, and we wanna look for – we have a list of typical opportunities in headworks of plants. And narration is going to be a significant focus in the INPLT training, because it consumes a pretty large percentage of most wastewater plant facilities' energy. So we'll have different equipment information on blowers and diffusers.  
  
We'll also, as I said, look at process opportunities. So, we wanna get into thinking about the process and where ewe might find aeration opportunities that were process related. Pumps are present in all water and wastewater systems, from the smallest to the largest, and many pumps run 365 days a year, 24 hours a day. And it's quite common to find that they're not optimized, so, that's a place that we will look at and spend some time with, to find ways to save energy in pump systems, which are present in all of our facilities. We will even take on the dreaded pump curve, and maybe we will even have some fun with it, which I get probably isn't everybody's idea of fun. It's kind of a geeky kind of fun, but I suggest to you that there maybe some fun in taking on the pump curve. When I first got into this business, I actually started in operations with a small operations consulting firm, in Corvallis, Oregon, in, oof, early '90s.   
  
And at that time, you know, I was helping settle down \_\_\_\_\_ plants at pulp and paper and food processing wastewater treatment facilities. And at that time, I used to hear, at a lot of plants, the idea that RAS and WAS control was an art: the art of wastewater treatment. And there's certainly and art to it and I don't wanna take away from that; I would also say that the science has really evolved quite significantly, since those times. And so, we can apply mass balances in a much more deliberate way; we have better instrumentation and better data available to us that help us better quantify the solids and the system, and better control. Hopefully, in a lot of facilities, we have better ability to control RAS and WAS, on a more of a scientific basis. And some of these scientific tools that we'll be presenting to you, like \_\_\_\_\_ analysis, allows you to take into account the settling characteristics, for instance, of today's wastewater, of the water you have, the *[audio cuts out]* you have in the basin today.  
  
You know, using the settleability information allows you to take a very scientific approach to RAS control, and so, we'll be looking for energy efficiency opportunities in RAS, and also in wasting, so that you can maintain the target SRT in a more deliberate and energy-efficient manner. And as I pointed in an earlier slide, what we find is, when we take hold of these controls, not only – well, when we take hold of these controls, with energy efficiency in mind, we often see – in fact, most of the plants that we've worked in have simultaneously seen better water quality, and better more consistent operation, you know, more crisis-free operation. So, we go in there looking for energy efficiency, and by being more deliberate and careful and scientific about setting these targets and calculating setpoints, we end up improving all of the performance, not just the energy performance. We will take an opportunity to look at the energy hog that is UV disinfection. Disinfection is important, and we wanna adequately disinfect our \_\_\_\_\_ and adequately disinfect our drinking water, if we're using UV.  
  
Well any way that we disinfect, we always wanna be successful, and complete, and meet the requirements of that disinfection. But there are multiple safety factors built into UV designs, and so, one of the ways we can go at energy performance of disinfection is to ask questions about the transmissivity, for instance, the transmissivity functions that are built into your plant. And distilled water has 100 percent transmittance, but wastewater, of course, and drinking water you have, depending on the source of your water, you know, transmittance is not 100 percent in most waters. And so, looking at what are the safety factors imbedded in your plant, and can we – some plants have very successfully sort of improved the energy performance, without sacrificing any water quality performance of their plants. We will also look at dewatering equipment; we are recognizing the energy implications of centrifuges and other high-intensity equipment, so, moving towards lower-intensity equipment can sometimes be an opportunity.   
  
So some of the considerations that we'll look at will help you look ahead; if you're considering changes in your equipment, you wanna have in mind what kinds of energy implications that has, and what kinds of energy opportunities you wanna be looking for as you move into consideration of new dewatering equipment. And then, from a process perspective, you know, when you dewater has some pretty big process implications, and so we'd be looking at not just the equipment aspect of dewatering, but also process considerations, and when you schedule operations like dewatering. In the training, we are gonna look at W3 water – sometimes it gets called plant water, sometimes it gets called 3 water. And whatever you call it, it's usually a good energy efficiency opportunity. It's not free – we tend to think of plant water as "free" – a great deal of energy is imbedded in it. And so, we will ask you to consider, what do we use W3 for? How much do you think you use? How much pumping or horsepower is dedicated to it? And how efficient is the plant, with W3? So those are some of the considerations.   
  
We have found many facilities find that they can save energy in their W3 systems. Fans, and order control, and HVAC, and lighting will be discussed; we should not overlook them, for at least three reasons: they can be a low-risk and easy-entry way to start getting savings; for plants that are having some internal resistance to changing setpoints, it can be a lot more attractive to change a setpoint on an HVAC system than to change a DO setpoint. *[Laughs]* So, sometimes that's a way to start moving the dial and get some success in getting energy savings, in what's a less scary way. There tend to be some risks perceived, and also sort of just historically considered that, as in place, lighting and HVAC fans and \_\_\_\_\_ control are all – they can just be sometimes easier to look at. They can be a surprisingly large percentage of energy use, especially at small facilities, and they are sometimes really horribly out-of-tune. Lane likes to point out that when you're building a plant, you know, who are the last folks on the site? They typically are the controls folks and the air balancing folks, and they are on-site balancing at tuning things at the very last minute of a project, and everybody just wants them out of there so they can wrap it up.   
  
So they tend to run through facilities pretty quickly, and check the boxes, and get out of there, and then it never gets optimized, none of the setpoints or settings get changed or even looked at ever again, so we're living with what might not be a very well-tuned system. I wanna look or talk for a minute, here, very specifically, about the water system, because there is that day four on water. I wanna make sure that you know that, on the water side, we are very much aware that there are three parameters driving the operation of a water system. And in an optimized system, we want all three of these to work together. So when we talk about, on the water day, we will be talking about hydraulic performance, which is pressure and velocity. We will be talking about water quality, which relates to age, and chlorine residual, and other aspects, you know, depending on the facility, which fluoride is sometimes an issue – there are various aspects of water quality – and also, energy efficiency.   
  
And these three parameters work together, and we wanna emphasize that an optimized system, we actually do a better job of all three of them. And so, again, by looking at energy efficiency, we're not sacrificing anything on the other two; we're looking for a place where we optimize all three of these really important priorities. We will talk through all of these, on the water day; we'll talk through the 5 Ls of water system optimization, and those are looping, and leaping, and losing, loading, and leaking. And we'll take a look at some tools to diagnose if your system is having that happen and what you can do about it given the tools that you have, and what kinds of improvements might be possible given what you have at your disposal in your facility and what the configuration of your facility is. So I wanna talk about some logistics for the training, because it's a short period of time we have with each other, and we wanna make sure we optimize the benefit.   
  
So, if you wanna get the most from this opportunity – and I hope that everybody's onboard with doing that – these are things you might wanna know coming in. How much energy does your plant use? Which systems use the most energy at your plant? And what energy efficiency improvements have you already made? What challenges have you encountered at your plant? And what would you like to bring back to your plant? And if you can bring a calculator, a laptop computer, and an open mind, a willingness to share concerns, that always helps. I would say that – I know there often are concerns in the room, and we want those on the table. I mean, I get that change is not always easy, and we definitely wanna discuss any concerns that folks have, right there in the room, and see what we can do to allay those concerns, or see what kinds of information we can bring from other facilities, experiences that we've had at other facilities that might help address your concerns. I guess I wanna ask, Mary, laptop, computer, I've got a question mark there, because I wasn't sure where you landed on that. Are folks bringing their own?

*Mary Tiger:* Yes, those that have laptops will bring them, and then I'm gonna work with IT to get some backups. And our goal is to have one computer for every two people, so that *[audio cuts out]*. But the classrooms that we're gonna be in don't have computers, so, gentlemen from Charleston, please bring your laptop if you can, and *[crosstalk]* share it *[laughs]* with somebody.

*Interviewer:* Okay. You know, how do we measure success from this training that we have together at the site? Well, for me, there's a couple different ways to measure success, and actually, in a few slides, we'll have an opportunity to have a little more of a discussion here, so I wanna hear from you kind of what you're thinking about that, too, the folks that are on the call. For me, it's successful when folks have a good time, and when they learn, and when they feel engaged about the training, and if they walk away with ideas for what they could do. And so, there are gonna be three pieces to this, coming out of the training: we wanna help you start on an opportunity register, you know, we want you to walk away with a very organized list of some opportunities that you've identified at your facility, so that you – and some of them may be short-term things you could do, and some of them may be much longer-term things. But we want you to get that opportunity register started, or if you already have one started, to get more items on it, from the work that we do together.   
  
We also want you to have a start on being able to estimate the savings of at least a few of those ideas, so we'll, again, using the energy tools that we're developing in the training, you'll be able to, based on what the equipment is, and the horsepower, and the runtime, what kinds of – start to, it helps you to triage, you know, which things are the highest, the biggest bang for your bunk, highest savings ideas. And we also want you, from just that pure O&M perspective, to have some understanding of, "What is in my control?" and maybe, "One thing I can do tomorrow, one thing I can do by next month, and one thing maybe we should stop doing." So those are the kinds of ways that we look at your takeaways, your things that, ideas that, if you have a good handle on that stuff, then we'll be doing well going forward. And so, from there, I wanna kind of open this up, and I will unmute everybody best I can – we'll see if that works – hang on – so, I think I've unmuted everybody I can, from my end.   
  
Some of them are telling me that – you might be muted on your end, so think about that if you start to talk and nobody is responding to you, maybe you're muted on your end. But I have now unmuted to the best of my ability here. So, I'll pick on the folks – I know you can probably talk, Mary, and the folks in your room, so I'll pick on you guys first. But in general, I think everybody's unmuted the best I can, and – any questions, or concerns, or ideas you wanna share at this point?

*Mary Tiger:* I'm getting some shrugs and head nods, here, but I think in general we're really excited about the opportunity, and we're just really looking forward to seeing what you have to teach, and making it applicable to what we're working on. So I think being at the plants is gonna be really helpful to kind of give a feedback of, like, "Yeah, we do that," or, "We don't do that," and then to go out and look at actual equipment and processes. So, I think we're really looking forward to it, and just hoping to get the *[audio cuts out]* there.

*Pat Davis:* So, Dawn, this is Pat, in follow-up to that point. For you to hit the ground running and to focus the technical stuff to what we have and what we do and how we do it, is there some background information, you know, SOPs to the plants or certain functions, that would be helpful for you to see and read *[audio cuts out]* of getting here at 7:00 that Monday?

*Interviewer: [Laughs]* Thanks, Pat, I appreciate that. Mary has sent me some information upfront, schematics, so I have a sense of what you have there at the plants, and sort of overview information. I probably won't be able to get into your SOPs, that level of detail, ahead of time. But if you guys can start thinking of that and so that you have in mind – \_\_\_\_\_ \_\_\_\_\_what helps me hit the ground running is when you folks show up really primed to hit the ground running yourself. Because one of the things that we really find for success in these programs is that, yes, I've seen a lot of systems, and, yes, I have suggestions and examples, but it really kind of doesn't matter what other plants have done, in the general sense. I can give you a great idea that I think would work really great at your facility, but what's really gonna work at your facility is what you're ready and interested and excited about doing.   
  
And so, hopefully, what I bring from other plants gives you new ideas that you haven't thought of already, and generally we find that to be true. But it's also true that I am not gonna be dictating or judging which are the best ideas for your facility. What I really wanna do is help you find the right combination of what are the top-three things for you that you have some traction to be able to move on tomorrow. Does that make sense?

*Pat Davis:* Sure.

*Interviewer:* So I have some information upfront for Mary, and I think I have what I need so far, and in the next couple weeks I'll be digging through it a little more, and if I have more questions, I'll definitely send them your way. And when it comes down to it, the best ideas are the ones that you guys like best, and that you guys feel motivated and empowered to make changes. That's where you're gonna make those changes, not what I tell you I think you should do. Anything else from Charleston or elsewhere? Okay, hearing none. Thanks for participating, today. Peter, do you have any closing comments that you wanted to say, if you're able to hear me?

*Peter Narbaitz:* No, I think it's really exciting, and I think, again, a lot of people at OWASA have been through a big push in pulling together their commendable energy management plan and all the opportunities considered there. So it's gonna be really great to build off that and see what we can confirm makes a lot of sense, what else we can add to it, and just keep the momentum going.

*Interviewer:* Terrific. Okay, well, with that, thank you very much. I'm looking forward to seeing you in May. If any questions or concerns come up between now and then, please let us know. And have a great afternoon.

*Mary Tiger:* Thanks so much, Dawn, we really appreciate *[audio cuts out]* looking forward do it. *[Crosstalk]*

*Interviewer:* Okay, great, me, too.

*[End of Audio]*