Transcript for Peer Exchange Network February Webinar: Level 2 Audits & Benchmarking - Part 2

Office of Energy Efficiency & Renewable Energy

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Pam Mendelson: Good morning, this is Pam Mendelson with the Department of Energy. I wanted to thank everybody for joining the call so far. I hope you are also connected to the webinar so you can see slides from our presenters. And I just wanted to let you know we're going to wait another few minutes as people are still signing in, and then we'll get started.

Okay, it looks like we've got a good crew on the call and I wanted to thank everyone for joining us. Again, this is Pam Mendelson with the Department of Energy. I'm very happy to be with you for an hour today to talk about important pieces of energy efficiency, knowledge and implementation in Alaska.

I just put up a slide to remind everybody of some of our operational needs here on the webinar, to make sure the line is clear and easy for everyone to here. We've muted all participants, except for the speakers. If you do have a question during the presentation we ask that you type it into the question panel that's on the right side of your computer screen so that we can read it out loud at the end.

Later, in March, you can check the RACEE website. We will provide a link to the recording and the transcription of this webinar and you can see the link there on the slide. We also are always looking for information from you and your colleagues on announcements that you think would be good to make on these webinars, and if you have an announcement of a new program or a resource or an event we ask you email that to Fletcher Tsuba, my colleague here at DOE so that we can be sure and mention it on the next webinar.

So we conduct these webinars as part of the RACEE Peer Network. The network is intended to provide a fundamental benefit to the 64 communities that pledge to reduce per capita energy usage by 15 percent by 2020. The network consists of several components. First of all the website on which we provide information, secondly the monthly technical webinars, and third we have to have in-person meetings over the course of the next three years to, certainly at the end of the working period for the communities that will be working on implementations of their technical assistance plans in phase two.

The goal of the Peer Exchange in RACEE is to empower Alaskan communities and native Alaskan villages to develop effective tools to advance the use of reliable, affordable, and energy efficient solutions that will be replicable throughout Alaska and other Arctic regions. And the Department is very fortunate to be able to leverage the existing convening power of the Alaska Energy Authority along with other regional energy efficiency organizations to form this Peer Exchange Network and build a community of energy efficiency information sharing and actions by Peer Exchange via webinars and events.

So going forward from today you can look forward to future webinar topics that explore experiences with air course heat pumps, indoor air quality issues and how to avoid problems with that, as well as biomass heat recovery systems and the programming that you may see now on the slide that we're looking at.

So with that I'd like to turn over the webinar to our first presenter, who is Amber McDonough, working with Siemens and has a great presentation for everybody on Energy Efficiency First: on Implementation Strategies. So with that I give it over to you, Amber.

Amber McDonough: Okay, thank you, Pam. I appreciate the introduction, and I appreciate the opportunity to present to the audience today. I'm an account executive for Siemens Industry, and helping me today is Peter Beardsley. He's a principal at Nortech. And we're going to continue a presentation that was started last month. The topic is Energy Efficiency First, meaning look to energy efficiency before you look at renewable energy or other, more expensive upgrades.

This is part two, this is implementation strategies, and basically part one was the first stage, with goal setting, and it basically – two other presenters: it was Lee Bolling from Kaufman Engineers and Jim Fowler from Energy Audits of Alaska that went through this first part, and it helped define why you should be interested and what your goals should be regarding energy efficiency, and they talked a little bit about benchmarking your facilities, setting up baselines, doing some data analysis and developing your project.

Today we're going to focus on what happens after you know what your project is, and how are you going to finance, construct it and validate that your savings are met. So again, part one was this preliminary work, and now we're going to transition into part two, which is the back half where work actually gets done.

So again, these are the three questions we're going to try to answer today. We know what we want to do; how are we going to pay for the improvements? How we are we going to get the work done? And how will we know if we actually achieved our goals regarding energy efficiency?

So staring off I want to talk about project financing. The first few are probably ones that folks are aware of. If you have a project you want to get done the first thing you look at is do I have the money to do it. You're going to – owners are going to look at their existing capital budgets and maintenance budgets to see if they can self-fund the project. In today's climate that's pretty hard to do.

The second way would be to pursue state or federal grants and appropriations. Five years ago even this was very lucrative. You could get grants for energy efficiency. There is the America Recovery Act. There were a lot of other programs out there. At this point that's, again, a well that has somewhat dried up.

The third way of securing project financing would be to look to lenders that you have existing relationships with: community banks and credit unions, other third parties like for example Bank of America is one that we work with. They actually have a $5 billion environmental lending goal for green projects and they want to lend that money over the next ten years. So they're very interested in funding these kind of energy efficiency projects.

Commercial lenders can also offer tax exempt municipal lease purchase agreements which Siemens has used with state entities in recent years to fund energy projects.

Other federal programs that have been used in recent years – I know of at least two or three significant deals that the USDA, U.S. Department of Agriculture, has assisted with. They have a rural development program that includes community direct loans, and some grants – the grants are fairly small in size. But this is another option if you want to try to find funding for your projects.

The next ones I want to talk about are specific to the State of Alaska. If you're part of a city or municipality that bonds regularly you're familiar with the Alaska Municipal Bond Bank. There is a states preferred bank, which is Key Bank, which will do loans up to ten years for qualified projects. There is Alaska Industrial Development and Export Authority's SETS program, which provides direct loans and loan guarantees for energy efficiency projects.

And then the last one, that's very much tailored to this kind of energy efficiency work is Alaska Housing Finance Corporation's Energy Efficiency Revolving Energy Loan Fund. This program, otherwise known as AEERLP, which is a bit of a tongue twister, was actually created in 2010 by the Alaska state legislature that authorized them to bond up to $250 million to fund energy improvements. All community-owned buildings within Alaska are eligible. So this means if you're a school district or a non-profit even there's talk that they will entertain this type of funding. You can apply for this energy efficiency revolving loan fund program.

These projects are designed to be cash flow neutral within the equipment life. So typically these loans extend up to a cap of 15 years, and the interest rates are fairly competitive. They are on a sliding scale, based on the term of the loan, so for example if you were going to take out a loan for five years as of this month the interest rate would be about 2.65 percent. If you wanted to take it up to 15 years that loan would be 4.125 percent. So that's kind of the current range for projects that Alaska Housing Finance would fund at this point.

The loans – they are loans, they're not grants, so you do have to repay the money, but it's designed so that the energy savings repay and are matched with the loan repayment value. So that's how owners pay them back. For loans over $250,000 HFC prefers that an energy services company guarantees savings many times through what's called an energy performance contract – and I'm going to go into that briefly in a few more slides.

And then the other thing to note is while in part one we talked about doing the investment grade audits and doing the analysis they require that your investment grade ought to be no older than 12 months. And this is simply because facility use changes, energy cost change, these audits have an expiration date and they get outdated. So that's some financing options for you to consider. I know I'm going fairly quickly but again we can have questions at the end.

Next I want to talk about several – there's actually four different procurement methods to get your project completed. So you've got your money, now how do you actually implement it? There's several that I'm going to talk about.

The first one is traditionally: how do owners get work done? Well, they hire an architectural engineering firm, that's AE firm, to finalize the bid documents and the design. They put the project out on the street, contractors bid. Typically the low bidder, bidding contractor, wins the contract and they win the right to construct it for the owner. Then the contract is awarded. However, the owner is on the hook for any budget overruns or scope changes, change orders as we like to call them, and neither the design firm or the contractor are really ultimately responsible for the performance of the project after it's done. So in the case of an energy efficiency project they're not on the hook to ensure that the intent, the goal of saving energy was achieved.

A more modern way, number two, is called design build. It has some similar aspects, but basically an owner would put out an RFP, request for proposal, for a design build team, and this team would include the design firm, the prime contractor and all the subcontractors to essentially finish the design and construction of their project. You know what you want to do; they're going to take it to completion.

Typically they have to work within a limited budget, and sometimes if they're over budget for the scope the owner must settle for what we call value engineering or

value engineered project, which just means that the scope has to be reduced to fit within the budget. So you don't always get exactly what you were hoping to get. And again, the design-build team is not responsible for the savings or performance outcomes.

All right, two more types I'm going to talk about. One was mentioned earlier; that's an energy savings performance contract. That's a more focused method. It's designed specifically to save energy and maintenance costs for the owners and it targets scope that's designed to do that. How you would procure this is you'd put out a request for qualifications or an RFQ to hire an energy services company, or ESCO.

The ESCO team would include the design firm, they would act as a prime contractor, and then they would also have subcontractors that rolled up under them. They would collaboratively work with the owner to finalize the energy efficiency project scope of work based primarily on the best return on investment for the owner. The ESCO would provide a guaranteed maximum price and all energy savings calculations up front. It would be firm and fixed.

Once the owner agreed to the project and there was an award the ESCO would then finalize the design and construction of the energy improvements, and ultimately the ESCO is on the hook for any costs overruns or scope changes. So that relieves the risk from the owner on that piece. And in addition they provide a performance guarantee, they guarantee that the savings that were originally proposed would be met.

The last way that owners sometimes construct these energy efficiency projects is to self-implement them. The challenge there is that the owners are limited to the availability of their existing staff and if costs go over or their scope changes that they can't accommodate they're responsible for that as well, and in addition they

also have to be responsible for any savings or performance outcomes and/or deficiencies.

So one more quick slide here. This is on energy savings performance contracting. It is very similar to the slides I showed you at the beginning of the presentation. There's a white and blue flow chart that showed developing the goals, doing the preliminary analysis, doing a detailed analysis and then implementation and what-not.

This is the exact same path; it's just simplified. Essentially if an owner decided to work with an ESCO the first step would be to learn the owner's goals and do some feasibility analysis? We would then – the owner would typically put out a request for qualifications to select an ESCO partner. Once that happened we would proceed with doing an investment grade audit and technical proposal. That's the detailed analysis part.

Once you had your fixed price and savings you could secure financing because you'd know what your payments could be and the term that you needed to go on your loan. Construction would be awarded. The ESCO would then implement the program. Once the program was completely constructed then we would enter what they called the Energy Savings Guarantee period and the savings would be validated with measurement and verification services which is what Peter's going to talk about.

Just two more slides here. I wanted to let any Rural Community members on the phone know about two statewide assistance programs that will help you procure energy efficiency project services. One is the Alaska Department of Transportation and Public Facilities Energy Office. They actually maintain a statewide energy savings performance contracting term agreement, or ESPC term agreement that is primarily designed for agencies with development, financing and implementation of energy projects. However they have made themselves available to all public entities

statewide. So if you're part of a tribal community or a rural, city or village, you can actually call up the energy office and get support from them.

This term agreement they maintain is good for five years and it includes pre-negotiated markups and labor rates. So everything's vetted, and you know that you're going to get good value for the services provided by the ESCOs. There's three prequalified ESCOs that develop the project via a competitive RFP process, a request for proposal process that happens after that's specific to each project that an owner might bring to the energy office. And there's no project size limits but they must be cost effective, which typically means that they still fit that 15-year project payback window. And typically the ESCOs have to provide at least a three-year savings guarantee using measurement verification reporting after the project's complete so that you know you're going to have the savings that were promised.

And this new term agreement there was a five-year term agreement that expired. This one, the new one, should be active in March 2017 if it's something you're interested in.

This is the last program I wanted to make you aware of and this is Alaska Housing and Finance Corporation's Energy Efficiency, Technical Assistance Center, or EETAC, or EE-tak. This, again, is available to all local and rural communities and school districts within Alaska. Alaska Housing Finance maintains some staff to help you either online, in person or over the phone with all kinds of predeveloped guides on how to identify and implement energy efficiency retrofits. They have energy use analysis software, financial tools and other calculators that will help you really evaluate what your use currently is and how you're going to reduce your energy use.

They also have people that can help you scope your projects and plan how you're going to implement it. They can help you identify funding sources. And they also maintain a list of ten prequalified energy efficiency project developers. And if you

had a particular project that you wanted help with they could help you solicit and partner with one of those project developers to help you through the process that I demonstrated on a previous slide, taking you from your goals all the way through construction and then through the savings and guarantee period.

So with that I'm done with my section talking about financing and construction. We're going to go next to Peter Beardsley from Nortech Engineering and he is going to talk about measurement and verification and ways you can validate you've actually achieved savings. And he's got a lot of very nice graphs and pictures.

Peter Beardsley: Thanks for that introduction, Amber. As she said, my name's Peter Beardsley, I'm a principal at Nortech and I'm here to talk about measurement and verification.

Most of my slides are based on the verification; this slide you see right in front of you. The question is did it work? Did we save what we thought we were going to save?

One of the key elements of that is measuring what you're using up front. I know that Jim and Lee talked about that last month, but that really can't be underestimated, the value of good measurement data. And we'll talk about that here in a minute.

The main question we have is – [off mic] – so the main question we have after we've done an energy efficiency project is did our energy efficiency project work. We like to remind people to focus primarily on energy use because energy costs vary, based on the cost of fuel, the cost of delivering fuel and other market conditions. So cost isn't the best measure, but energy use is. Are we using less electricity? Are we using less heating oil, natural gas, or even wood?

The main thing we want to know is what is our building doing? When we are there we have a pretty good idea of whether the lights are on, whether the temperature's comfortable. But what is our building doing when we aren't there? Do we feel like we have control of the building systems, now that we've done our energy efficiency project? Are our occupants more comfortable? Are we getting fewer complaints from our occupants about either being too hot or too cold or too drafty? Are we having fewer maintenance calls? Do we have fewer leaks? Do we have less lamps out? Again, less drafts and things like that. And are we spending less repairing fixtures and equipment?

Some of those, what I'm going to focus on right in this doc is the actual measurement of the electrical and heating oil loads. Those are things that we as engineers are very focused on because we can measure that. We get nice graphs.

The other things like the occupant comfort, maintenance calls, those are things that building managers really have to focus on themselves over time, and just get a feel for how their building's operating.

My main focus on measurement and verification is comparing the building energy use before and after the upgrade. One of the main things we need to do when we do this is make sure that the building uses are similar and that the building schedule is similar. Or, we need to make corrections for those differences. For example we've done work in buildings where once the building was upgraded it became a lot more popular for use on weekends because it was warm and well-lit and people wanted to use it more. So when we first looked at it the energy use didn't really go down. We had to dig in a little bit deeper and verify that the building's schedule and use had changed so that on a per-hour use basis the energy use had in fact done down.

Measurement and verification should be aligned with the overall energy efficiency project. Amber mentioned that on the ESCO projects there's usually a three-year window where they have to – they're contractually required to do measurement and verification. It should also be – some projects have longer than three-year payback periods and there should be some way to maintain that review on an annual basis, at least throughout the whole payback period to make sure that the energy efficiency upgrades are working, and that the performance of those upgrades is being maintained. When you put in control systems that are set to match the building schedule you need to make sure that those are still functioning many years after the upgrade.

The measurement and verification system should also be aligned with operator's goals for understanding the energy use changes over time. If they're really interested in hour-by-hour measurements and how the building's performing with temperature variations then you need to put in a detailed oriented verification system, whereas if it's really just trying to look on a month-to-month basis you can do that with bills from the energy providers.

The measurement and verification should also be aligned with the complexity of the systems that have been changed to achieve the energy savings. If you're putting in a complex control system then you should have a measurement and verification system that is aligned with that so that you can measure the changes that you've made, the fine tuning you've done of your building. Lighting upgrades are an example of something that's actually a fairly easy energy savings modification and it's also easy to measure with your monthly utility bill from the power company.

There's several different ways to do measurement and verification; as I suggested I'm going to run through them here fairly quickly. You can do measurement and verification through evaluation of the monthly or periodic bills. This is continuation of the benchmarking that was done during the energy audit.

This is a straightforward process for most entities. They can either get the bills directly from the electric company or the heating oil provider or the natural gas company or from the accounting department of the entity, of the owner of the building.

This is routinely performed by ESCOs to document the contractually-guaranteed savings. It's required by several different funding programs: the HFC program, the USDA program and some others that may be required by private bank or funding source. And it's great documentation. When you stack up the year before the energy retrofit and the year after the energy retrofit and you can see that the graphs are lower you can get a lot of buy in with a fairly simple graph.

Electrical use is usually directly comparable. You take out one type of – either an incandescent or fluorescent lamp, replace it with LED, the electrical use goes down and there it is, every day, every hour the light's on and on a month-to-month basis it's clear.

Heating oil and wood and other heating fuel is a little bit more difficult to measure and show year to year differences. This must be corrected for heating degree days because you can have a relatively mild winter and that'll make it look like you saved a lot of heating fuel, and you did. But it wasn't because of the energy efficiency upgrade, it was just because there was less heat necessary for the building.

Other utilities that are a little less common to address in energy audits or things like cooking fuel, propane, for example, water – those should also be directly comparable as long as the building use has remained comparable.

To get slightly more detailed data building owners or maintenance staff can do their own recording of major building systems periodically, based on what they want to

know about their building. Sometimes energy efficiency upgrades will include a new boiler with hour meter or other measurement device that isn't necessarily recorded on a continuous basis but can be read off the meter itself. Also monitoring the fuel level in tanks; a lot of times these can be measured on a weekly basis. The electric meter that's on the front of the utility can also be read and you can put hour meters on other major electrical consumers, their handlers and the like, and get an idea of whether the units are operating more or less than they used to. This also helps maintenance staff in determining when maintenance needs to be done. Boilers should be maintained at certain intervals, filters need to be cleaned on certain intervals, and when you switch from a continuously operating system to an occupancy-controlled system, for example, your filters will last a lot longer because now your units are only running ten hours a day instead of 24 hours a day.

So having those kind of meters on there is handy; having it written down is handy and it helps maintenance staff in particular with the periodic maintenance that's necessary. And a lot of times you can see a reduction in run hours and the like.

This kind of data can also be used to more frequency reconcile the delivered energy and the consumed energy. The most common issue there is theft of energy which heating oil is a common thing people are capable of taking. We get a lot of calls about, "My fuel left. The fuel company filled my 500-gallon tank last week and now my boiler has run out of fuel." And sometimes there's a leak, sometimes there's theft.

This also helps verify that equipment's operating during hours of occupancy. As I said, if you're writing down your hours once a week on the air handler and you see that it should have run 50 hours, five ten hours during the week and it's run 100 hours then you know that you need to go look at that piece of equipment and figure out why it's running so much.

As I said, this energy use data can be – is important to building maintenance staff so they can update their programs. It's also good for users and occupants to see. There's some schools here in Fairbanks and one of the libraries has an energy use dashboard where folks that use the building can see differences and they can make efforts across the school to try to reduce their energy load and then they can see if they were successful.

What I'm going to show you slides from is from a continuous trending of equipment, temperatures and other data. This is common with more complex systems where there's sensors that are controlling occupancy sensors for lights, and demand control ventilation. The easiest way to do this is often through the existing building control system. Those systems can be set to collect the data frequently on whatever interval folks are interested in. Sometimes getting the data out can be a little bit difficult and graphing it can be a little bit difficult. But collecting the data is the important part. There's also third party monitoring systems that can be used that are basically what I like to call clamp-on systems where you can just walk into a building, put these sensors on for temperature and electrical load and start collecting data immediately.

Continuous trending can be used to verify a wide variety of information: equipment schedules or matching occupancies, occupancy and photo sensors are working and controlling the systems that they're supposed to control, and things like temperatures recovering from nighttime setbacks. Also the temperatures are maintained during occupancy or if your building occupancy like an office building actually produces a lot of heat, so you can sometimes measure those differences as well.

The data can be used to troubleshoot concerns and fine-tune building operations. I think that ESCOs with performance guarantees are good users of this because they're on the hook to make sure that you save the energy that they have guaranteed you. And so they'll help fine tune your building so that it's working the way that they

expect and that your energy use is reduced. This can also be performed by building owners, maintenance staff and users to maintain systems and troubleshoot systems.

Now I'm going to run through a couple of case studies and talk about the different ways measurement and verification can work. This first one was a traditional design bid-build we did with Tri-Valley School in Healy. This is the graph of actually the energy cost for this building. They had the opportunity – they had a coal boiler and an oil boiler. The coal boiler heated about three-quarters of the school; the oil boiler heated the newest quarter. It was put in when heating oil was fairly inexpensive and operated for many years. And then when we did the audit we realized that the coal boiler had significantly more capacity and could heat the whole school if they connected it to the heating system in the elementary wing.

So a heating loop was installed. Unfortunately this doesn't really reduce the energy use significantly but it reduces the energy cost through direct displacement of heating oil. The measurement and verification on this is going to be pretty easy because they're just going to use less heating oil – at least that's the plan. Every BTU of coal heat they put in should reduce a BTU of heating oil. Continued benchmarking, probably on an annual basis, is appropriate for this. We haven't gone back and looked at this yet because this was just put online in September, so we don't have data on how much fuel consumption has actually gone down. But this was a good project, and you can see that the payback here is going to be fairly quick. It was less than four years. And this was a $275,000 capital improvement project they did.

The next project is the YKHC Community Health Services Building in Bethel. The top graph here shows the electrical use that was identified in the audit. You can see that the annual baseload, the red line is stepping up on an annual basis. So something's going on in this building that's increasing the energy load but no one knew what it was – the occupancy and the use hadn't really changed. In order to get this building back down into the lower level where we thought the use should be we recommended

doing existing building commissioning to identify, and things that were not being controlled the way they were designed and basically bringing the building back to its original operating standards.

This process took several iterations because first we had to go find all the systems then figure out if they were doing operating correctly, figure out if the controls were working correctly, the control sequences were working correctly, replace and repair things that were not working correctly and then go back and do it again.

During this effort we installed and replaced missing and failed sensors. We reprogrammed the scheduling so that the air handling equipment was off during unoccupied hours. We programmed the heating system pumps and motors to be off when there was no heat requested within the building.

Probably after update, scheduling the air handlers, the next biggest savings was to repair the broken outside air dampers so that they limited the intake of fresh air to what was needed instead of being fully open. And then we programmed setbacks for unoccupied hours and weekends and holidays.

This is a building that has the opportunity for continuous trending through the existing control system, and that was what was used to troubleshoot a number of the problems was to verify, okay, when the building's occupied it should be pulling in fresh air; the air handler should be running. What's it doing when there isn't anyone here? And finding out that these things were running all night showed us the opportunity for the savings.

The owner has asked for monthly benchmarking to document these savings and that's what we did here for the first couple months, the table on the bottom shows heating oil consumption. The top is – the 2012 number is where it was burning about

three gallons per heating degree day. In 2016, right before we started the existing building commissioning effort it was burning about six gallons per heating degree day, so something had happened between 2012 and 2016 that had actually pushed energy use even higher. And then in March 2016 you can see we dropped the heating oil use down to two gallons per heating degree day. That's a decrease of 66 percent from the previous month. And that's all on a heating degree day basis. That's not just because March was nice.

This was so dramatic that the heating oil delivery actually called the building owner ten days after we started and asked what we had done to the building.

The rest of my slides are about our own building here. We used the last option Amber discussed. We self-primed this where we're engineers and we think we know something about project management, so we undertook multiple energy efficiency and renewable energy upgrades between 2011 and 2016. In 2012 we did the electrical – we replaced all our lights with LEDs and we did some work on our heating oil system, the electrical benchmarking, which is what's shown here is great. You can see the orange line, was 2013 it's lower, and every month across the board. So that was great. We one REAP's Great Alaska Energy Challenge for heating oil reduction. I think I saw Sean on the list of attendees here. So we'll give a call out to REAP for that.

But as I said, we're a bunch of engineers and we said, "Well, what else could we monitor? And what else could we install?" So we installed a thermal solar heating system and control for space heating and domestic hot water. We installed pulse meters on our heating oil boiler and on our PV array that we installed to generate electric for our peak summer load. And we installed an additional monitoring system.

Once we had those systems going we realized that it was nice to look at each one individually but we wanted to try to find something that let us look at all that

together. That's what the upcoming slides are.

So this slide here is our total office energy use. This is on a daily basis for the last half of January and the first half of February of this year. It's consistent with the fact that we would expect to use a lot of energy this time of year. It's cold and dark. And here's our total building energy use. The red is heating oil; the blue is the electrical load and heating oil is a lot higher than the electrical load. This is measured in kilowatt hours which doesn't make a lot of sense for heating oil so we wanted to move a little closer to heating oil. We also measured this in gallons. We wanted to make sure, okay, is our building behaving the way we would expect it to?

So we have gallons of heating oil on the right, the outdoor temperature on the left. You can see the heating oil is the blue lines and when it's cold, down in the minus 40 to minus 50 range we burn twice as much heating oil on a daily basis as we do when the temperature is more up in the 15 to 20-degree range. So this helps us understand that our building is operating within our expectations. It also shows us that on the coldest days our boiler is running 16 hours a day. That's pretty good utilization for a boiler.

This system also lets us monitor temperatures across a variety of things. I won't go too deep into this but as you can see there's six temperatures. What this shows us is that the bottom line is the outdoor temperature in the same period of January 15th to March 6th. The upper line is our boiler temperature. You can see as the temperature goes up – our outdoor reset is working so our boiler temperature is going down. So that's saving us energy.

The difference between the top two lines is showing us that our building is having less demand for heat as the temperature goes up, which also makes sense. The second line from the bottom is the room temperature of our main office where most of our employees work. We have a nighttime setback that you can see is operating on

the right. On the left we turned that off when it was very cold because we realized our building was not capable of recovering from the setbacks and as the temperature dips off to the right you can see there recovery time gets a little warmer in the morning.

You can also see – one of my favorite things in this graph is in January there's really no difference between day and night. You can just tell the temperature is just kind of doing something but it's more related to the weather. When you get over to the right, over about the beginning, the first of February you can start to see the sun actually warms things up a little bit during the day. So that's – you know, something we can all feel.

We also could use our system for troubleshooting occupant comfort. This graph shows the operation of a thermostat with a setback. It goes down; it goes up. It's a nice step line. The yellow line is the thermostat for our main office where we were having trouble controlling the temperature. So we went back and we got periodic complaints of, "Oh, it's too cold." Nobody was complaining that it was too warm.

But this is actually the temperature – the yellow line is the temperature that the thermostat was calling for, and we traced that back to a loose wire. And as you can see that's a difficult thing to troubleshoot without continuous trending because you just have these periodic occupant comfort comments.

This is our hourly electric use. So this actually matches up very nicely with our electric bill on a monthly basis. We go back and reconcile that with GVA. The top of this chart for most of it is our total load; the red is what we have purchased from the electric utility. The blue is what our solar panels are making. And so in the middle of the graph there's a peak that's our daytime load, and then our nighttime load is the flat spots in the middle. The blue is actually energy we're not buying from GVA, it's energy we're producing here. You can see it makes a significant dent in our daytime

load, even here in the middle of February. And then on the weekends, off to the right, those are a Saturday and a Sunday. You can see we're actually off the grid a little bit last Saturday, which is exciting.

But then we said to ourselves, "Well what's going on on the weekends here when we're not here?" During the day, on a weekday, we're all here and computers are on, lights are on and all that. So we went back into our data to figure out where was our electricity going. And I won't bore you with too much of this, but the answer was we have plug-ins on timers for our vehicles. And those come on and run all day, even on the weekends. So we're going to reprogram those timers.

Real quickly here: what's most interesting to note here is that the vehicle plugins are the two highest lines across the top on the right. There's a light blue one and a light orange one. The next two lines that are the highest for the whole period are the continuously operating servers and desktops that operate continuously, which are not things that you think of when you walk into a building and you think, "Oh, what's this building using for energy?" What you usually think is, "Oh, it's the interior lights." Those are a step down on the yellow, near the top of all the things.

And here you can also see our boiler cycles, and there's a purple squiggly line all the way across the bottom which turned out to be the Keurig coffee maker, which was keeping itself hot day and night, just in case someone wanted a cup of coffee. You can see right at the end there on the right, as soon as we noticed that we turned that thing off. It's not a huge load compared to a vehicle plug in, but it is continuous.

So measurement and verifications are important parts to the energy efficiency project. It's how we discuss what we actually are saving in energy. Continued benchmarking is the easiest thing to do, just continually looking at the monthly bills using a spreadsheet, the original benchmarking spreadsheet is a good thing to do. There's also a software such as Portfolio Manager which can automate these, the

comparison of the post energy efficiency upgrade to the pre-upgrade energy use. And you can also compare it to similar buildings in the state and across the country.

Trending data can be developed from building controls or standalone measurement and verification packages. A lot of times controls personnel are consultants with or experienced with the specific system. Necessary trending data can be useful to troubleshoot a tremendous amount of things. It does cost money to get that trending data, but a lot of times you can find the source of occupant complaints within a week or less.

Our experience is that, you know, like the Keurig, a knowledgeable and engaged user can reduce energy consumption. All you have to do is turn some of these things off. Desktop computers, coffee makers and the like – every little bit helps. And energy consumption data should be presented to the occupants that are interested. A knowledgeable occupant and user is your best step forward to reducing energy consumption.

Then just to conclude with an overall energy efficiency – why energy efficiency and how to move it forward: auditing and measurement are the key to documenting how much energy a building uses and maintaining the success of an energy efficiency project. You really have to look at the bills to understand what's going on in a building and what you can do about it. And there's really no project that's too big or too small, from replacing lightbulbs to replacing air handlers; they all make a difference.

And getting the word out – we were talking about this a little bit before we started the presentation: getting the word out is probably the most important thing that anyone can do to help others. Demonstrate your success, whether it's a lamp replacement, a street light upgrade, exterior light upgrade, appliance upgrades, refrigeration or

heating appliances, up to retrofitting whole schools or clinics. Get the success out there. Talk to the folks you know that operate similar buildings and spread the word.

It's important to remember that energy costs are not controlled by us, or the building users, but energy use can be. So whenever you hear people complaining about how much energy costs and kind of feeling hopeless about it provide the reminder that energy use can be controlled. And that's the most important part of the bill: how much energy costs can't be controlled but how much your use can be.

So with that I will give the controls back to Monica and Pam for questions and/or final comments.

Pam Mendelson: Thank you, Peter. It looks like we actually don't have any questions, so I didn't know if you and Amber wanted to have any final comments before we end the webinar.

Amber McDonough: I don't. I just think that – oh, go ahead, Peter.

Peter Beardsley: I was going to say that's why I have this slide here. I like to leave this slide here until everybody's check out because this is really – this is why energy efficiency first. It's how you justify doing it first and how you get other folks to do it. I see there's a lot of folks I know from different conferences and we've all talked about how to spread the word of why energy efficiency first. So hopefully this week's webinar and last week's webinar will help get that word out.

Amber McDonough: Yeah, definitely. And I just wanted to second Peter's last comment about controlling costs. I think we both feel the same way when we hear comments about the high cost of energy in Alaska, and a lot of folks are good about

conserving and they're aware of it but there's always more you can do. And this really is the first step. Renewables are lot more exciting and attractive. On some levels they're expensive and harder to maintain, but the reality is if you get your energy use down then you need smaller renewable energy system, and that cuts the costs of those type of systems as well right off the top. That's why we're all big components of addressing energy efficiency.

Pam Mendelson: And it looks like we do have some questions coming in. So this one goes to Peter. On Nortech's PV is it hooked into GVEA's grid or through a batter bank? And then there's a follow-up question to that.

Peter Beardsley: Okay, we're part of the GVA's SNAP program and so we have a Net meter. And that was actually part of why we installed the monitoring system we did: we don't have a battery backup. We are either using our energy onsite first or selling it back to GVA. And GVA Net meter was telling us what we were purchasing but it doesn't tell you what you spend backwards. And the solar panel tells you what it's producing but we actually had to install this third party monitoring system to see our total building load at all times.

And that's the follow-up?

Pam Mendelson: What sensors are being used for monitoring electrical use of individual appliances?

Peter Beardsley: We have installed – we went to the panel and said we don't measure individual appliances, we're measuring circuits. And so our system has the ability – we have two, eight, sixteen – I think we can monitor 48 individual circuits right now which half of them are turned off in that graph.

And then we go through the circuit and try to figure out what's turning on and off refrigerators and the like. It took us the better part of a day of fiddling around with it to figure out what we were really measuring.

Amber McDonough: Hey Peter you retrofitted, that, right? It was just some clamp-on donuts that go in the entire circuit?

Peter Beardsley: Yeah, we have CP clamps that are on the building feeds and on the circuits we are most interested in, and not in individual appliances.

Amber McDonough: Yeah, they make pretty slick retrofit kits for distribution panels that will pick up individual loads that you can install. Then you'd need some way of monitoring it. But there are some packages out there I've seen that at pretty nice for that.

Peter Beardsley: And what we like about the one that we've been using is this – the graphical interface is really handy. You can zoom in and out; you can look at specific days, pick date ranges, turn meters on and off. It's pretty handy. We'd love to install it on one of your buildings – for a small fee.

Pam Mendelson: Thank you both. There are a few other questions. Do you have time or should I go ahead and pull the biz over to you?

Peter Beardsley: This is Peter. I have time.

Female: I'd love to see if we could hear a few more questions.

Amber McDonough: Sure, and I can stay for a while too. Not a problem.

Pam Mendelson: Okay, Amber: are there monitoring systems for – does Siemens have monitoring systems for building owner or do you only see the data?

Amber McDonough: No, actually we prefer is the building owner has the monitoring system so they can interact with it and understand it on a daily basis. Siemens is an energy service company but we also do building automation systems. So we can actually provide our own or use one that you already have. The other piece of that is if you don't have a system – I was thinking about it when Peter was mentioning it – about using what we call a building automation system or a digital energy control system – some buildings are just too small. And so if we need to figure out what's going on in the building a lot of times, like Peter said, you can put in temporary data loggers. You can set them onsite to monitor occupancy and temperatures and motor run times for maybe two or four weeks or whatever interval made sense. And then the engineer that was assisting you could come back with that data and do kind of a deep dive on what your use schedules were and that kind of thing. So it can be temporary – ideally it's permanent so that the building owner can take advantage of it.

Pam Mendelson: Awesome. All right, well that was the last question that we had, so thank you both so much.

Amber McDonough: All right, thank you.

Peter Beardsley: Thank you for putting this on.

Female: Thank you very much for your time today and hopefully everyone can join us next month for the next webinar. And with that we'll close the webinar for today.

Amber McDonough: All right. And these presentations will be posted online, correct?

Female: Yes, you can check back to the website in March. It takes a couple weeks to get them transcribed.

Pam Mendelson: But the presentation is available online on the peer exchange network.

Female: Great. Thank you for that.

Pam Mendelson: Thank you.

Amber McDonough: Thank you.

[End of Audio]

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