

Holly Carr:

...Better Buildings Challenge partners. Hi everyone. We seem to be having some difficulty with audio. Are folks able to hear? You can send a message through – okay, it sounds like we have audio. Okay, I'm getting lots of yeses from the audience. Thank you very much. Let's start again. Here we go. I am Holly Carr with the US Department of Energy. I'd like to welcome you to season 2 of the Better Buildings Webinar Series. In this series we profile the best practices of Better Buildings Challenge partners, Better Buildings Alliance members, and aligned organizations who are all working to improve energy efficiency in our buildings.

Today we'll be focusing in on Better Buildings Challenge partners who have taken advantage of the Building Re-tuning Program to help spur energy savings in their building portfolios. Next slide please. So here's the plan for this session: I will first pass the baton onto Ben Goldstein here at the Department of Energy to give a brief overview of the Re-tuning Program. Then we'll hear from Steve Harrison at Parmenter Realty Partners and Dennis Bohlayer from Towson University about their experiences with retuning in their portfolio.

Next we'll hear from Lisa Shulock with Penn State University and the Center for Building Energy Innovation who will talk about the future of the Building Re-tuning Program and how you can take advantage of this program. Then we'll connect you with some retuning resources, which are available to you online and we'll conclude by taking audience questions. Next slide please. Let's go ahead and introduce our presenters today.

First off is Benjamin Goldstein. He manages the Better Buildings Workforce Program at the US Department of Energy where he oversees programs to support a high-quality commercial buildings workforce through nationally recognized training and certification programs and developed and delivered in partnership with industry.

Next we have Steve Harrison who's been active in commercial real estate since 1974 and is currently Managing Director of Facilities and Sustainability with Parmenter Realty Partners. Steve is responsible for sustainability as it relates to day-to-day operations at Parmenter Realty Partners' properties and he also serves on the executive committee for BOMA International and is on the board of BOMA Southern Region.

Our third presenter is Dennis Bohlayer who is the Director of Energy, Engineering, and Conservation within the Facilities

Management Department at Towson University in Maryland. He has previously held positions of Associate Director of Engineering and Director of Operations and Maintenance within the same department. He joined Towson in 1997 after 24 years as an officer in the Coast Guard.

And finally Lisa Shulock is a Penn State Research Project Manager at the Consortium for Building Energy Innovation in Philadelphia. She oversees the Consortium's Building Re-tuning Training Program, which has trained 114 people and conducted re-tuning walk-downs at 32 industrial, government, and educational and commercial buildings so thanks very much to all four of our presenters. Next slide please.

I'd like to just remind our audience to send in questions through the webinar screen at the bottom chat interface on your webinar screen. We will be collecting all of those questions and asking as many as we can of our presenters at the end of the presentation. Now let's turn to Benjamin to answer the question you've all been asking, which is what is building re-tuning? Benjamin can you enlighten us?

Benjamin Goldstein: Thank you Holly and yes. Let's proceed to the next slide. So building re-tuning is two things and there's one thing that it is not. It is a systematic process, it's a methodology to identify and correct building operational problems and correct them through low or no-cost operational measures. You can see the graphic here depicting building performance over time and how with periodic re-tuning you can move the needle closer to building optimal energy consumption and there's a list in the second bullet of some typical building re-tuning measures that are identified through the process including identifying and replacing sensors, adjusting set points, VAS schedules, and similar type processes. Next slide.

Building re-tuning is also a training program and the Department of Energy through the Pacific Northwest National Laboratory has developed a series of training materials that are available online including PowerPoint slides, instructor materials, and two very engaging online simulation-based training modules. Our partners in industry have also been delivering building re-tuning training live. As you can see in the photos on the slide here there's a classroom component, which usually lasts one day or a day and a half complimented or followed by a building walk-down component, which is usually the second half of the second day where the attendees physically walk through the building and kind of practice what they've learned over the last day and a half.

The thing that building re-tuning is not is it's not a replacement for a robust, whole-building, retro commissioning process completed and implemented by a certified commissioning professional. Building re-tuning is a methodology that is really handy for building operators, building engineers, kind of your day-to-day staff in buildings but like I said it's not a replacement for a whole building retro commissioning process that is typically done every few years to really tune up a building and bring it back to optimal performance. So building re-tuning compliments or supplements the retro commissioning process. Next slide.

Holly Carr: Okay, thank you Benjamin. Now let's turn it over to Steve Harrison at Parmenter Realty Partners. Steve can you tell us about your experience with re-tuning earlier this year?

Steve Harrison: Thank you Holly. I'd be delighted. Parmenter Realty Partners own and operate buildings throughout the southeast and southwest with two buildings in Richmond and another building in Washington. We're a value-add business model. We purchase under-performing buildings and turn them around, which is very exciting for us because we get the opportunity for us because we get the opportunity to go in and do all the energy upgrades and we're very open to doing energy upgrades.

Parmenter Green, which I'm a part of, is a division focused on every aspect of sustainability and energy performance. We chose re-tuning because we saw that this was an opportunity for us to take a look at a building that was under-performing. We had struggled with staffing and finding a qualified chief engineer to run the properties so we didn't have the person on-site that really had the understanding of the energy management system. I think we've moved a couple of slides; I'm sorry. Go another one and one more.

So in our preparation for re-tuning we identified Las Colinas Tower II in Dallas, Texas. It was one of our buildings with a very low ENERGY STAR score and we sat down with the team from PNNL and asked where you want us to start and the first thing they wanted was trending and they were looking at some 200 points that they wanted to trend so we gave them remote access to the building automation system and the first problem that we identified was the inability for us to be able to give them access to the system and that was a real problem and was probably a first indicator that we had a larger problem with the EMS system.

We found that the EMS wasn't set up to trend at that moment and when we worked with the EMS provider they just struggled with trying to make the system do what we needed it to do to get the information that PNNL needed. So in doing so and one thing I think that's very hard for us in property management is we open up our buildings to let others look in and see what we were doing. Next slide please.

On our training days we gathered Parmenter employees from all over Texas. We brought our engineers that were in the Dallas area, we brought one of our engineers up from Houston, and in addition we brought an engineer down from Richmond, Virginia. So in the classroom we did a live building automation system review, which we ran into another problem in that our vendor was unable to get us linked in for about an hour to the system, which was another indicator that we had another problem with the VAS that we needed to identify and correct. And then we started to look at the trends in detail.

What was interesting to me when we started looking at the trends was the outside air temperature was 17 degrees off and I happened to have my iPhone, I looked up that area that we were in, I looked at the outside temperature and I said, "Hmm, that's 17 degrees difference. Something's not correct." We did a walk-down of the interior and exterior spaces, we went on the roof, we went in the central plant, it was very cold, it was 30 degrees and if you know Dallas it's very flat and very windy in the winter time so it was pretty cool when we were outside. It gave us an opportunity while we were walking the building to see areas where the cold area was coming in, where the heat was leaking out, and we also noticed that the economizer function of the building was not working and that the engineers that were on the property were a little bit reluctant to use the economizer even if it was working. They felt like they couldn't cool the building in the wintertime without using the chillers.

We did a review of the mechanical plans, which is very important. We've learned over the years that you've got to first understand what's in your building and how everything is connected so a review of the mechanical plans was essential and then again we used infrared scanner and temperature gun and saw where we had air infiltration and we saw some surface temperatures especially on the glass where we were picking up a lot of heat in the wintertime at the glass that we were having to cool the exterior walls of the building and they were doing it with the chillers instead of using outside air.

This was the first time again to open it up to outside entities. We actually brought in the City of Dallas and JC Penney to be part of our training and we feel like that open communications is essential, that engineers – I've always felt like engineers should be talking to each other across the cities and comparing notes to see what's going on in each other's buildings. Next slide please.

One of the things that really jumped out at us and we understood it but it was just emphasized in this process is if you don't have a qualified chief engineer that really understands mechanical equipment you're at a tremendous handicap. And one of the processes is to educate the owners and asset managers that they really need to have a highly skilled team managing their buildings.

This was very apparent to us with the junior engineers. I went in there one morning and the chiller failed to start, they got the chillers on late, the building had heated up and they were answering hot calls and making adjustments on the thermostats and I had to tell them, "You don't need to adjust thermostats. Your problem was your chiller didn't start on time." So it's essential to have a really strong chief engineer in place.

We found a lot of other things too where things were improperly positioned or not calibrated like I said by the outside sensor. The impact the EMS operations have on the building is very evident. And we learned too the on-site chief engineer and all the other engineers as well need to really understand the EMS system and we've really ramped up our training on the EMS system since we did the re-tuning training.

And then one of the things that has really been evident in this whole process is that there are a lot of vendors out there that are selling energy upgrades but we've found that the first step in any process is to understand what you have at the building and make sure what is already at the building is working properly. Sometimes the original design was not such a bad design to start with and when you make upgrades the upgrades need to enhance the system and sometimes we found that upgrades worked against the system so that was an eye-opener to us, especially since we took re-tuning to Richmond, Virginia to one of our other buildings.

We went up there and found out that we had two systems that were working in conjunction with each other and one chill water system was heating up the other chill water system causing us to have to run two chillers when we could get by with just one chiller. So

again it's going back to making what you have work properly. And then one of the other elements I think is having a qualified mechanical engineer that you can turn to and have evaluate projects before you make a decision to install something in your building. Next slide please.

The results – my screen went blank so I've got to get it going again – you know it really caused us to have a more in-depth investigation of the systems in the buildings. We really opened up a can of worms at Las Colinas and once we opened the can of worms we went back to the building and we found that there were just so many things that were not working correctly that I called in an army of vendors that had been working in the building and sat down at a table and I said, "All right, I'm going to throw these things on the table. If it's something you work on you grab it and you take it," and we had one mechanical contractor that was looking at duct work and dampers, we had one mechanical contractor that was looking at the air system and the pneumatics in the building, we had another mechanical contractor that was looking at the flow rates and looking at all the valves that had to do with the chill water system and the condenser water system.

They all grabbed their stuff and we went through the building with a fine tooth comb and when we came back we found valves that were inoperable, we found pneumatics that were not working properly, stopped up filters where we were not getting enough pneumatic air to the top of the building; there were just all kinds of things that we uncovered. They came back with a list of repairs and then we assigned each one of them the task to go out and make the repairs to make the building operate properly. So this was very critical in what we were doing and it was something that was just so important to us to make sure that every vendor that came in that building was working together and helping each other to achieve the goal that we were trying to achieve. Next slide please.

And then as you can see by the graph we have since last October started making improvements in the energy consumption in the building and we have – our ENERGY STAR scores have been gradually going up and our consumption has been going down and it's been an average of ten percent every month over the previous year. The big problem was that we had a lot of HVAC complaints and those just dropped to nothing after we got on top of the building and started figuring out what was wrong with the building and actually addressing everything in the buildings so now we have tenants that are happy instead of tenants that were

complaining all of the time. That wraps up my part of the presentation.

Holly Carr:

All right. Thank you so much Steve. It will be really exciting to see how the ideas from this building and this training are able to impact your buildings across the portfolio over time so thanks for sharing your initial results and your experience. I will also mention that Parmenter's also making great progress and is on track to meet its Better Buildings Challenge energy reduction goal for its entire portfolio and this is one of many tools in their toolkit towards getting to that 20 percent reduction goal. Next up is Dennis Bohlayer. Dennis can you provide another perspective on re-tuning from your recent experience hosting the training at Towson?

Dennis Bohlayer:

Yes Holly, I'd be glad to. Next slide please. Welcome folks. Next slide please. Welcome to Towson University. Here's a snapshot of our campus here. We are the second largest public school higher ed institution in the State of Maryland with a 22,000-student body. Next slide. We have a number of external drivers, Towson University being a public institution and also a member of the University System of Maryland so we have a number of State of Maryland mandates listed here. Next slide.

Our leadership has also made a number of commitments, one of them being a signatory to the President's Climate Commitment and also just recently signing on for the Better Buildings Challenge. Next slide please. I have a number of slides I'm going to go through here as I quickly run through them but I want the content there as a resource for you for viewing later on. But we did host the training here. The good staff from the Pacific Northwest National Labs came in and the focus of the training was for the State of Maryland facility managers and it was a two-day event as folks previously mentioned with the first day being classroom and the second day being fieldwork. Next slide.

So our patient and the subject for the fieldwork was our largest building on campus, which was the Center for the Arts, where in 2006 it went through a large renovation with a number of additions around the perimeter of the building such that it almost doubled in size. Included in the scope of the project was a complete replacement of all the mechanical systems, which was a big plus. Next slide.

So the next couple of slides give you a visual of what the inside of the building looks like. It's a four-level building with a large

atrium and it has a number of other functions and it's everything, dance, art, music, theater, all the fine arts, et cetera. Here's a snapshot of the building HVAC equipment that is within the Center for Fine Arts just to give you an idea of the size and the complexity of the building. Next slide.

So you might ask why we chose this particular building for our patient. Well the first reaction was from the HVAC supervisor that we'll probably find some things there. Obviously he was aware of a number of issues. It is a very large building, has a lot of diverse functions, it had known comfort issues, had known design-related issues; we expected a lot of high-value energy conservation opportunities and of course my thought was let's start with something hard and everything later will seem easy. Next slide.

So in favor for re-tuning we do have a couple of things going for us. One, we do have two people that are very gifted on controls experience. The other is we do have what I think is one of the better building automation systems out there called Automated Logic and we also have real-time metered utilities coming through from all of our buildings on campus and so it's a – those are the things that favored re-tuning here. Next slide.

Just a little bit on Automated Logic, web controlled, it's web-based, great graphics, and the last piece here is that it has a nice time-lapse tool that you can review the behavior for the last 24 hours. Next slide. Here's just a snapshot of what a building mechanic might see for a floor of the building using color to indicate set point satisfaction. Anything dark red means something is way out of balance; either it's way too cool or way too hot. Next slide.

Here are some of the graphics that we have with our system. Next slide, next slide. This is a view of our Logic page. Next slide. This allows a lot of the programming so we have good hands-on, user-friendly features here to do our re-tuning through adjustments to our building automation programming. Next slide. This is a snapshot of our electrical demand for the Center for Fine Arts. Note the odd waveforms at the end of the week that apparently our main chiller in the building was going through some sort of surge effort there so you can see the anomaly very readily. Next slide.

This is an add-on to Automated Logic, which shows a report function, and this shows the electrical KWH during the month of July for the Center for Fine Arts and we'll come back to this slide later. Next slide. So our field day, the walk-down came back with

these observations. This is dealing mostly with the building envelope and the lighting. Next slide.

These are HVAC-related. You can imagine as the host for the re-tuning conference how embarrassed I was to find that we had empty spaces and very low temperatures. Next slide. These are some of the other observations that we found just in that one day of walking through the building. Next slide.

So the re-tuning report that came from PNNL these are the definitions that they provide for you as far as effort and potential savings. Next slide. And so for our particular building they have identified an assortment of ECMs and these are all HVAC-related, which illustrate how like nine are high-savings and very low effort and so that's where you want to be. You want to be in this particular table in the lower right hand corner. Next slide.

Again additional report findings by the laboratory – next slide. So as I mentioned HVAC scheduling was the number one opportunity uncovered and it can't get much simpler than this: just plain turn it off. Next slide. So finding that we did the round up of the usual suspects and we pulled everybody together and we said, "What's going on?" and the revelation from this was that number one, it was intentional; bleeding the academic year's schedule into the summer was intentional. There was a lot of confusion as to what roles people were playing, a lack of understanding of the building and what zones they served, and there was widespread fear of upsetting the occupants and adversely affecting some of the specialty equipment contained therein. So the outcome of that was no real, "Let's get it done," but more of a "Let's be careful if you do anything," and we did as a consequence implement a fourth of July schedule. Next slide.

This is just an example of the force field analysis that I did as a facilitation tool for conducting the meeting just as a reference for you. Essentially we were trying to move from the current state to a desired state and so we used this as a tool just to have the discussion and the debate. Next slide.

Going back to the fourth of July holiday you can see that Saturday, Sunday, Monday there, those three days, had tremendous opportunity there just for going into an unoccupied setting for a building automation system. Next slide. So with that in respect to things not in our favor for doing building re-tuning is that we had to get through this fear complex, this idea that we are going to get complaints, that we're going to adversely affect specialty

equipment, et cetera, et cetera, so this was on our tasks to overcome some of these organizational elements. Next slide.

Some other things, obviously with Automated Logic we have a lot of input data coming in to us; we just don't have many eyes looking at it so we need to have more of a focused effort on looking at this information that's streaming into us, we need to have a more focused effort on lock downs and ECM implementation, and the other part of course that everybody has to deal with is not enough resources really to do the job properly. Next slide.

So here are some reactions that we have taken thus far. We had a busy construction season so the two resources that normally we would use for re-tuning were hung up with overseeing some of the commissioning effort and some of the capital projects coming online but these are some of the things that we did start to gain ground on. Next slide.

One of the great outcomes of the training was this use of e-Cam to really pull in raw data and look at it in a different way using trend analysis and I would encourage everyone to spend some time using this free tool. It's a bolt on or an add-on into a Microsoft Excel spreadsheet. Next slide. So these are some of the benefits that I found and took away from the training session. Next slide. And some lessons learned, just get out there and walk your buildings, collect the data, work off the fax, remember you're dealing with occupant perceptions when you start getting into some of the adjustments that you make and in our case this re-tuning task seemed to be overwhelming but as I mentioned earlier we're going to ease ourselves in and take it one step at a time. Next slide. That's all. Thank you.

Holly Carr:

Great. Thank you so much Dennis. I just want to remind our audience that we are collecting your questions. You can send it questions through the little question box as a part of your webinar interface and we're collecting those and we'll ask as many as we can at the end. Also we did have a question about whether or not this presentation will be available afterwards and yes, we do archive both the slide presentation and the audio as well and we post them to the Better Buildings Webinar website. Anyone who is registered for this presentation will receive an email with a link to that archive as soon as it becomes available, probably in about a week or so or less.

Great so our last presenter, our final presenter, is Lisa Shulock

from the Center for Building Energy Innovation. You are probably wondering how you can tune up your own building or how you can take advantage of this training to see some improvements in your portfolio and Lisa is here to talk about the answer to that question. Lisa...

Lisa Shulock:

Good afternoon everybody. I'm talking briefly about a partnership that we're involved with here at the Consortium with the Department of Energy and BOMA International and you can move to the next slide. So the Consortium for Building Energy Innovation, previously known as the Energy Efficient Buildings Hub some of you may be familiar with, it's based at the Philadelphia Navy Yard and we're focused on small and medium-sized commercial building energy efficiency. Next please.

So a little bit – you heard background from Benjamin earlier and I just wanted to emphasize a couple of points, which is the training and the curriculum that was used to train the folks that you previously heard from was developed by the Pacific Northwest National Lab and the original curriculum was focused on large buildings with building automation systems and then there was a recognition and many of you on this call perhaps might be associated with buildings that don't have building automation systems because the vast majority of commercial buildings are smaller and do not have BAS so the curriculum was modified to address how do you do building re-tuning when you don't have automation systems.

At the Consortium we received funding along with two other organizations that it was the only funds that went through the National Institute for Standards in Technology Manufacturing Extension Program and for the last almost two years now we've been modifying the PNNL curriculum to really meet the small to medium size commercial building audience primarily doing – we've done a lot of walk-downs. We've done 32 buildings and 114 people in the Philadelphia region. We've now moved to the next phase of our project with the Department of Energy – and you can move to the next slide – where while 32 buildings may sound like a lot it's really from our perspective because we did them all just obviously a tiny drop in the bucket and if we're really gonna have impact nation-wide in terms of reducing building energy use we have to have much broader dissemination of this training program. So with DOE support we've partnered with BOMA International and we're creating a "Train the Trainer" model.

So PNNL were the trainers for Towson and Parmenter but PNNL

is really more of a research lab and they don't have an infinite number of trainers to go out across the country. So we are going to be training trainers in a pilot mode this year and we're going to two different BOMA associations, which I'll talk about in a moment, to train people in the local community how to do building re-tuning training. This first phase we're going to be focused on smaller buildings without BAS. Next slide please.

So the goal is to eventually be training thousands of people around the country but we first need to test this "Train the Trainer" model and is it possible to train let's say someone like Steve or Dennis or some of the folks on their teams to do this training and then to train other people on their staffs or other people in their communities. So our first pilot is going to be in October with BOMA Wisconsin in Milwaukee and the second one will be in San Diego with BOMA San Diego in February.

So those are this coming year the opportunities to actually attend an in-person building re-tuning training. Those will be the only two opportunities that are directly funded by the Department of Energy and you can contact myself or Scott Morris from BOMA International if you're interested but there are also some of the folks who have been trained in the course of the last two years by PNNL and by the folks who are part of the grant that I mentioned earlier are offering this without direct DOE support. There are some activities in New York State, in New York City I think partially subsidized by NYSERDA and there's other activities around the country but when Martha gets on the – presents in a few minutes I think she'll talk about some of those resources where you can find the online resources and potentially links to where there may be activities in your community. That wraps up my official presentation. Thank you.

Holly Carr:

Great. Thank you Lisa. And as Lisa mentioned we have a number of great online resources as well that folks can access right now. Benjamin Goldstein is going to come back on for just a moment and speak to these and let you know where all of these things are. Benjamin?

Benjamin Goldstein:

Great. Thanks Holly. So on this slide you'll see listed on the left hand column the training resources that are currently available for free online, both on the Pacific Northwest National Lab website with the URL on the right and also on the DOE Commercial Buildings Resource Database, which I'll show a link to in the next slide. But as I mentioned earlier there's an instructor's manual, there's two very in-depth curricula, one on large buildings, one on

small buildings, there's the e-Cam Excel tool, which I believe Dennis mentioned available for download and then there's a couple of case studies with more coming soon.

And then I also mentioned in my opening remarks the two online simulation-based training courses that PNNL has developed, which are also available in a little bit more of an interactive model than the PowerPoint size but they supplement each other. Next slide. So this is the Commercial Buildings Resource Database the DOE maintains. It's a very user-friendly interface and so if you just go in and type in re-tuning it'll pull up all the resources that were on that previous list and that URL is down there at the bottom of the slide. Next slide.

So as Lisa mentioned we have kind of stepped back from directly funding training through Pacific Northwest National Laboratory and are trying to help support an industry-driven training delivery model going forward so there's the CDEI and BOMA International partnership with the two training pilots this year and then hopefully more following that. There's also NYSERDA in New York is subsidizing building re-tuning training and there's a couple of providers that are in New York and NYSERDA has a list of that training on its website and then there's all the existing material that PNNL has developed that anybody can really pick up and use. It's very user-friendly to either train within an organization or to try to deliver more broadly. There's no copyrights on the material. You can turn it into a Broadway musical if you want to but it's more effective as a building operator training tool.

I think that's it for the resources. I guess the last thing I'll mention is we did a pilot over the last few years with the Manufacturing Extension Partnership, which is part of the National Institute of Standards and Technology. There are a few sites around the country that I believe are going to continue offering training on a fee for service basis in Northern California at NANEX, which is the local manufacturing center and partnership there, in New York City through CUNY with the City University of New York and then in upstate New York through Rochester NEP. So if you're in those geographic areas you can look up those manufacturing extension partnership centers who may be considering to offer a fee-for-service model. That's it.

Holly Carr:

Okay Benjamin. You've given me a great idea for an upcoming webinar, Building Re-tuning, the Musical. Thank you very much. We've received a lot of questions from the audience so I'm going to pivot us towards the Q&A section and the first question I'd like

to address actually for Steve. We had a general question from an audience member, “What is trending?” Steve would you mind giving just a quick overview of trending for a building and using the building automation system?

Steve Harrison: Trending is a setting on your EMS system where you can go in and select any point that you're receiving data and capture the data over a period of time. And they typically work in 15-minute intervals so when you're – suppose you've got an area in your building that you're kind of concerned about. Then you start trending that area in your EMS and you watch and see what's happening. It could be temperatures, it could be start times, it could be how fast the building is warming after you shut down so you get an indication of how soon you can actually stop your chillers if you're stopping them too soon or if you need to keep them on longer. So all the points that you have sensors on your EMS system you can trend.

Holly Carr: Thank you Steve. Another question directed towards you all at Parmenter, “How old was the system in the building that you were working in at Las Colinas?”

Steve Harrison: The system was original to the building. It was 30 years old. It had a few upgrades over time. I'm not certain that the upgrades – since it some of them were prior to our ownership I'm not certain that they really looked at everything and calibrated everything when they did the upgrades so we found a number of things that needed to be recalibrated.

Holly Carr: And as a follow up to that, and Dennis you're welcomed to answer this question as well, but based on the re-tuning walk-down, the classroom session, and then the field day how much of – I guess were any new systems installed in your buildings based on the feedback and the findings or was it all just adjustments to your existing system whether it was 10 years or 20 years old and I guess Steve if you could take that question first?

Steve Harrison: At Las Colinas it wasn't that we added new systems; it was repairing some things that were not working and recalibrating some things that were out of calibration, moving the outside air sensor to another location, and it was on a roof that we actually installed an ENERGY STAR roof and the reflectivity of the new roof was causing the sensor to give us an inaccurate reading so we had to move the sensor to a shady place on the roof where it was not giving us that reflectivity.

Dennis Bohlayer: For Towson University most of the things we're working on right now are software programming issues where we just don't have – we're bringing in way too much outside air unnecessarily. It's fine-tuning the controls especially and as I mentioned turning things off, getting the schedules right that we can have this agreement with the occupants as to where the sensitive pianos and organs and things are in the building so that we don't have to run the entire building with that sensitivity. So for us so far it's been software although we have identified a number of retrofit opportunities as well.

Holly Carr: Thank you. Steve you mentioned taking re-tuning to another building in your portfolio in Richmond. This is a follow up to that comment and again a question for both Steve and Dennis, how are you doing that? So you had one two-day session with folks from PNNL, you looked in-depth at one building; what are the mechanics of taking that daylong training and some of the work that happened afterwards and trying to expand that across your portfolio? Are you training individual building engineers across your portfolio? Dennis are you working with building engineers across the campus yet or have you not gotten to that point and what do you expect moving forward? How are you going to make that happen?

Steve Harrison: What we did with our engineers, we believe in training as an ongoing thing. We actually require that they have 24 hours of training a year; that's for all our engineers. Every month we have a monthly call with our chief engineers and so we developed an action log of all the things that we identified during our re-tuning training at Las Colinas and we sent that out to all our chief engineers and then on our next conference call we went over all the points and discussed those and told them, "Now we want you to take this into your building and identify what you can find that needs to be corrected in your building and send us back the list of actions that you took."

And then we have an annual engineers meeting where we bring our chief engineers together and we did a recap of what everybody found and what we found at Las Colinas and continued the conversation and then we went back and the engineer in Richmond really dug his heels in and started finding a lot of things that were incorrect with his system. And so he just recently last month started valving off some chill water valves that were letting water get back and mixed in with the chill water and heat the water up so we look for that building to start improving its ENERGY STAR score soon and we look for the energy consumption to really drop

in that building. But we have really focused on our engineers' education and told them if they need EMS training we want them to have it so find somebody locally that can give you the training.

Dennis Bohlayer: I think at Towson our two persons that have the expertise, once we've kind of evened the keel here I think will be more involved with the building operations and maintenance folks that are actually in the building to give them some training on the fundamentals and there's certainly a lot of parts of the building controls that they can be monitoring. I mentioned that we have so much static coming into us through the building automation system they can be trained to actually be seeing a lot of that and making adjustments without the need to go to our HVAC shop for that so that's part of I think the cultural shift that we'll be implementing here.

Holly Carr: Okay, thank you Dennis. Lisa I had a couple of how is this different from questions for you. First of all one participant asking how the re-tuning program is different from a retro commissioning? We talked a little bit about that at the beginning but if you could go into more detail about how the program is complementary to a retro commissioning program and then we had another person ask how the re-tuning training is different from the Building Operator Certification administered by the Northwest Energy Efficiency Council if you're familiar with that?

Lisa Shulock: Yes, I can address both of those questions. In terms of how building re-tuning training is different than retro commissioning there's two components. First of all building re-tuning the curriculum is really focused on the operations and facilities staff who are in these buildings every day and have an opportunity to make adjustments, many of which we've heard Dennis and Steve talk about whereas retro commissioning typically you have an outside engineer or engineering firm that's coming in and it's a single point in time or over a short period of time where observations are made and adjustments are made but then that engineering team leaves and the operations staff – but then things can deteriorate back to less than efficient operations whereas if your building operations team is trained and observing and making adjustments you should have more optimal operations all year round. So that's probably the biggest difference between the two and then the other thing is that the focus here is on training staff, again giving the staff in the buildings the tools, the information they need to make a difference.

In terms of how this differs from the Building Operator

Certification program the BOC as it's known is a much longer, intensive program. I don't remember how many hours but it's several weeks of classroom training and it, of course, covers a lot of energy topics but there's other topics as well that are covered. I recently spoke to somebody from the Northwest Energy Efficiency Council, which licenses the Building Operator Certification training, and they are looking into incorporating some of the building re-tuning curriculum into I think they said it was their level two training but there's some overlap. We've actually had some people – in Pennsylvania we ran a couple of Building Operator Certification programs and some people who took that class then went on to take building re-tuning training and that counted for their ongoing – they need a certain number of training hours to keep their certification up and the building re-tuning training was eligible for maintaining their certification.

Holly Carr: Great, thanks Lisa. One question regarding service contracts with buildings and BAS manufacturers for Steve and for Dennis. Have your re-tuning results affected those service contracts or relationships in any way? Have you gotten any feedback from those folks?

Steve Harrison: Yes, actually at Las Colinas we let our EMS contractor go and hired another EMS contractor and we actually went in and rewrote the entire program because it's gotten so messed up that we had several problems that just kept showing up. But it's very important and we tell our engineers this that they have to have qualified people working on their system and they really need to understand it well enough to know whether people are qualified or not qualified. So it's – having a qualified vendor is very important.

Dennis Bohlayer: Yeah, we are mostly in-house with our controls from a standpoint of making adjustments on software. We do rely on of course a controls vendor to come in, which would be Automated Logic, to actually do any capital project or new construction or large-scale renovation that's beyond our means. But we try to keep the expertise in-house to really manager our HVAC controls.

Holly Carr: Thank you and one final question for Steve and Dennis if you have any of this data yet but someone wondering about cost benefit from the re-tuning experience, the cost to bring all of your staff in to do this and make the various upgrades versus the energy saved and the utility maintenance cost savings. Any thoughts there or specific numbers yet?

Steve Harrison: The cost saving is in the amount of electricity that you're saving by making all the adjustments and finely tuning your equipment. We are really focused, and I go back and forth with the asset managers, as far as engineers are concerned we're focused on how much KW we're using versus what we were using last year and in comparison to when we started the re-tuning training to what we're actually reducing every month. So we can turn that into dollars and cents but we're so focused on what we're saving and our engineers tend to understand KWH a lot more than cost because cost is a variable. It depends on what the utility company is charging you and they can go up on your rates or down on your rates so we really focus on KWH.

Dennis Bohlayer: Yes, for Towson the opportunities are huge. The Center for the Arts building during the summer was running \$1200, \$1300 a day in electricity only so you can see for that one July chart there by putting the building into unoccupied and weekends when we know it's not in use we can save tremendously on the power. Our issue there is really the music faculty I guess and their concerns about the pianos and they've sent us threatening emails saying we're going to have to pay for their piano re-tuning et cetera, et cetera so that's where we've got to get together. I've talked to a number of other schools and they don't seem to have the hostility from the music department that we do here. So for a very simple implementation there's going to be huge savings.

Holly Carr: Thanks Dennis. We've received so many great questions and one of the last ones we received was about occupant engagement and occupant behavior and how that plays into the success of the re-tuning effort. Unfortunately it's 3:59 and I know we need to finish up here but it certainly sounds like both of you have worked significantly with building occupants to bring them on board and to increase the success of the program.

We had one question I think that Lisa might be able to answer pretty quickly which is how often should we be re-tuning our buildings? Is there a recommended once a year, once every three years?

Lisa Shulock: Ideally you're going to do it every season and it's your operators so you're not bringing in any outside expensive consultants to do it.

Holly Carr: Okay and that answers another question about whether this would be a third-party activity or your own building engineering staff and yeah, we're definitely hoping our own staff in our buildings can learn to do this and do it on a regular basis. So thank you very

much to our presenters.

We're coming to the end of our session this afternoon. Before we do finish up I want to make you aware of the October webinar session, which will be focused on Property Assessed Clean Energy or PACE financing. PACE financing is a vehicle to pay for energy efficiency improvements or renewable energy installations on private property. Local or state governments or other entities fund the upfront cost of these improvements, which are then paid back by the building owner over time through property assessments added to the owner's property tax bills. We'll have the City of Milwaukee, Clean Fund, and Hilton Hotel Los Angeles Universal City coming together to describe their successful experiences with PACE financing as program developers, city administrators, and property administrators who have used this to get work done on their properties.

You can register it now from the Better Buildings Challenge home page and with that I'd just like to really thank our panelists once again very much for taking the time to present your organizations' work for our audience today. Please feel free to contact our presenters directly. You have all of their contact information here on this final slide. If you'd like to learn more about the Better Buildings Challenge or the Alliance please check out our website or feel free to contact me or the Better Buildings Alliance lead Kristen Taddonio directly at our emails. I encourage you to follow the Better Buildings Initiative on Twitter for all the latest information and you will receive an email notice when the archive of this session is available online.

Thanks to everyone for your participation. Goodbye.

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