Holly Carr: Hi, there. I'm Holly Carr, with the US Department of Energy, and I'd like to welcome you to the January edition of the Better Buildings Webinar Series. In this series, we profile the best practices of Better Buildings Challenge and Alliance partners, and other organizations working to improve energy efficiency in buildings. Today, we'll be taking a look down the road a bit, at up and coming technologies that could become key arrows in the building energy efficiency quiver.

We'll hear, first, from our very own Andy Mitchell, at DOE, who will describe our HIT Catalyst program – stands for High Impact Technologies. And we'll be talking about how DOE scours the globe to find market-ready technologies with the most promise for big energy savings in US buildings. Andy will describe our program to demonstrate these technologies in real buildings, with real people, as an on-ramp to increase adoption.

Next, we'll hear about two of this year's HIT Catalyst Technology Demonstration projects. We'll speak with Roberto Nunez, from host site New York Presbyterian Hospital, and also with Udi Meirav, from enVerid. We will regale you with a description of the technologies in the demos, and hopefully some early results.

And then, finally, we'll let you know of existing and upcoming opportunities to demonstrate exciting new technologies, with DOE, in your buildings.

So, without further ado, let's move up I think maybe two slides, since. There you go – that's what's happening, and here are our presenters. So let me introduce our presenters in a little bit more detail.

Andrew Mitchell is a fellow, supporting the Department of Energy's Better Buildings Alliance. In this role, Andrew manages the technical solutions teams, by balancing input from Alliance members and from the private sector, as well as industry experts, and our National Labs. Andrew has held positions at General Electric, AEP Energy, and EnerNOC, before coming to us at DOE.

Next, Roberto Nunez. Roberto is the Director of Facilities Operations and Engineering, at the Allen Hospital and the Spine Hospital, for New York Presbyterian Hospital, in New York. Roberto has been working with New York Presbyterian for 12 years, and has 17 years of experience working with direct digital controls.

Finally, Dr. Udi Meirav is the founder and chief executive officer of Boston-based enVerid systems, which has developed and commercialized groundbreaking HVAC load reduction technology. A modular intelligence scrubber system for indoor air, that enables dramatic reductions in HVAC energy consumption in commercial buildings. Before enVerid, he served as CEO of Boston-based Luminus Devices, an independent developer of high-performance LEDs for solid state lighting applications. Udi also has a Ph.D. in physics, from MIT, and his early career started out as a semiconductor research scientist.

So, thanks to all three of you for joining us on the webinar, today, to talk about these new technologies, and the demonstration work that you're doing with DOE.

Before we get started with our speakers, I want to remind our audience that we will hold questions until near the end of our session. Please do send in questions that you have throughout the presentations, through that chat box window on your webinar screen. We'll be collecting those throughout the session, and we'll certainly try to get to as many of them as we possibly can.

Also, this session will be archived and posted to the Better Buildings Solutions Center website, for your reference.

To start us off, let's go ahead and get the download from Andy, on how DOE's Building Technology Demonstration and Deployment program works, and an overview of this year's highlighted technologies. Andy?

Andrew Mitchell: All right, thanks a lot, Holly. So, my role, here, is to fill in and sort of explain how the DOE decides what cutting-edge building technologies to focus on. And what we do, once we have identified them.

Take me to the next slide, please.

We call these cutting-edge technologies High Impact Technologies, or HITs. Which is kind of a catchy name, in the world of energy efficiency. It's tough to come up with these sort of inspiring titles, but the HIT list is one of'em.

So the high-impact technologies are cost-effective, underutilized, energy efficient commercial building technologies. Through the HIT Catalyst program, which was initiated in 2014, DOE identifies and guides HITs through their early market introduction phases.

Ultimately leading them to broader markets, through partnerships with commercial buildings, industry – that's via Better Buildings Alliance – federal leaders, regional nonprofits, utilities, and efficiency organizations.

HIT Catalyst also serve as the umbrella program under which all of the commercial buildings' integration programs, technology-specific deployment activities fall. And that is along with the Tech to Market initiative, at DOE – very similar – which plays an important role in many HIT Catalyst market transformation activities.

Go to the next slide, here, and I'm gonna walk through these three steps of how we proceed with high impact technologies.

So step one is identifying, how do we decide what to focus on? HIT prioritization is conducted each year based on quantitative foundational criteria, developed through a transparent, collaborative, and consistent methodology designed to drive technologies through a step-by-step evaluation.

In short, the DOE – the Department of Energy – is acting, here, as an objective resource, to evaluate the vast, wide world of options that are out there. And provide that information, free of charge, to the decision-makers of America. So that you all can decide where to focus your limited resources, to be as efficient as possible while still maintaining productivity, and, overall, allowing our society to flourish.

DOE has no skin in the game. We hear this a lot from our partners, that they're constantly being bombarded with phone calls from sales reps. And sales reps certainly are important, and they have a difficult job, at times, spreading the word of this new technology. We see our role, here, as being, again, that objective resource, to promote just the ideas in general, and let those decision-makers then take it from there and decide what to purchase.

So, the HIT prioritization methodology helps prioritize technologies for deployment, focus, and also ensures open, consistent two-way transfer of information and feedback. Selected technologies demonstrate large potential energy savings. They have potential for widespread adoption by energy stakeholders, and they need to benefit from involvement by the HIT Catalyst program.

So, information on hundreds of technologies is consolidated into

the HIT matrix, for screening and evaluation. We literally – I think the last list was, certainly over 500, but 700 different energy conservation measures, or energy efficiency measures. And they're put through several screens, to be assessed.

The initial screening, here, you can see, is basically to assess for technology and logistics. It filters out technologies that are not applicable to the HIT Catalyst program. That's based on technical and energy savings factors. It might be a great invention, it just doesn't save enough energy nationally to be worth the focus.

The technologies need to have a high energy savings potential. They have to be relatively underutilized. So if a technology has great potential but it's already everywhere, there's no reason for us to focus on it. They also need to be ready for large scale deployment, in order to pass this first screen.

The secondary screen. This is where we take market factors into account. So technologies are assigned a score according to five factors. That's stakeholder interest, criticality of DOE involvement, manufacturing capacity, cost effectiveness, and cost reduction potential. If a technology is lacking on any one of those five, it's probably not gonna be in that top five high impact technologies, which we have listed on the right, there.

A bit of a spoiler, if we go to the next slide.

Without further ado, here are the five high impact technologies for last year and this year. LED troffers with controls. Packages of building management information systems – basically, energy data management. Shading attachment and awnings – pretty simple technology, there, but very important. Refrigeration controls and display case retrofits – primarily in grocery and cold storage settings. And then, commercial fans and blowers – anyone in a building, right now, is probably near a vent and feeling that air move. That air is moved by electricity and energy, and we wanna find ways to save that.

So, as we evaluate these energy efficiency measures, we take'em through over 20 criteria. We go beyond simple energy savings potential, and also take a quantitative look at other factors. Like the market readiness level – I mentioned that. Will people actually buy this? Is it ready for prime time? The production capacity is another factor. Is there sufficient manufacturing, out there, to produce enough of technology x, to actually make a difference nationally?

And then, finally, is there a role for government support, here? If a technology is taking off on its own, should we allocate scarce resources – taxpayer dollars, in this case – to promoting it? Probably not. So there are some cases where there's a perfectly good technology, but it's already moving, and it doesn't require an objective assessment from Department of Energy, to support it.

Peer workshops and responses to an annual request for information are incorporated into the HIT matrix, to provide perspective on market factors. DOE seeks feedbacks from academics, federal agencies, utilities, regional energy efficiency organizations, technology providers, and building owners and operators. We want all comers to come and share their opinions on these technologies.

The top scoring technologies are prioritized in this HIT list, and will then move on to define the game plan phase, which we'll get to next.

I have a few links peppered in here. There's also more resources at the end. But certainly this information is easy to find on the DOE website. You can use those links or do a basic Google search.

On the next slide, I'm looking at, basically, how we define the game plan once we have these high impact technologies selected. In this case, basically, what I'm doing is taking a look at the typical response. What is the objection that we're getting? I know people in the sales world deal with objections all the time. We do the same thing, and this is how we decide what to do next.

So, "The cost is too high." We'll do a challenge. "Oo, I'd like to, but there's too many barriers." We can develop some resources. If there's uncertainty, we can do a demonstration. And if there needs to be some critical mass, we'll do an adoption campaign. So I'll go through those right now, real quick.

Next slide?

If we identify high impact technology, and the general response we get is, "Yeah, that's good, but the cost is too high," Department of Energy can issue a challenge. So we'll implement this to overcome a communication failure in the market. When building owners desire a specific product that is not being provided by manufacturers, or it's too expensive, DOE organizes building owners, identifies required specifications, and helps to challenge manufacturers to meet this demand.

Bottom right, there, we have an example of a rooftop unit. This is going back to 2010, when DOE issued the rooftop unit challenge to foster the production of more efficient rooftop units. And that was, by most accounts, a success. By 2014, 21 RTU models exceeded the criteria that we set out, and that was up from 0 only 4 years prior. So DOE verifies performance and recognizes winning manufacturers for these challenges. In that case, it was Carrier and Daikin.

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Okay, second core activity, to promote high impact technology, stimulating the market by providing resources. Pretty basic, here. When the building owners say, "Mm, there's too many barriers, uncertainties, or unknowns." "I don't get it," in short. What we can do is provide guidance on product selection, for key technical and energy performance issues, as buyers develop their purchasing criteria.

We work with purchasers, tech providers, and other stakeholders, to identify technology attributes that will enable product, technical, and energy performance. Tech specs are accompanied by a demonstration, and case studies that support their value. So those specifications, which are available for at least ten technologies, are listed on our website.

We'll also provide high impact technology application resources. Those help users operate their devices correctly.

Next slide?

The third core activity, to promote high impact technologies – which is the topic of this webinar – stimulate the market by providing performance with a demonstration. That is, technical demonstrations. Real building demonstrations address the lack of objective performance and cost data that inhibits some technologies from finding their customer base. DOE helps identify, install, and monitor the performance of high impact technologies, in a real-world installation. And then communicate the results to the public via a case study.

So, this is kind of about addressing risk. Decision-makers have limited availability of resources. They're concerned that if they allocate those resources wrongly they might lose their job, they might be held up for public derision. So, if the question is, "Does

this technology really work?" DOE will work with technology manufacturers. We'll find sites. We'll work with National Labs, to be that, again, objective third-party measurement and verification service, to show that the technology really does work.

We'll get case studies. We'll publish reports. We'll show that it's out there. It works. It can be bought. In a few minutes, we have two great examples of technology demonstrations in action. One is a host site, the other is a technology manufacturer.

So, for those on the call, listening, if you wanna get involved, Better Buildings members are notified of these opportunities first. So, please, just another plug to join Better Buildings. And, also, again, that's a hotlink, there. You can sign up for a host demo site here, and that links to the High Impact Technology Hub, which is also listed later on.

Next slide?

Finally, the last activity we take on to promote high impact technologies is to stimulate the market with an adoption campaign. This is when the owners say, "You know, I see that the, for instance, LED lights are everywhere, but I think I'm gonna wait. I think I'm gonna wait, and retrofit my parking lot once it's more common, maybe once the price has come down, once I can see that it's been done out there." Again, to some extent, it's that risk aversion, certainly an issue in any publicly-funded operation.

This adoption campaign, this is the terminal HIT activity. It incorporates many of the other resources developed for the other program, such as specifications and case studies. The Department of Energy, through Better Buildings Alliance, works with industry partnership organizations, providing technical support to encourage their members to commit to installing a high impact technology.

I'm gonna go through real quick, here – actually, I'm just about out of time, so I'm gonna move through'em, but – The three campaigns we have going on, right now, are the Interior Lighting Campaign, the LEEP Campaign which focuses on lighting in parking, and the Advanced Rooftop Unit Campaign.

In all those cases, I encourage people to join. If you're doing a project related to interior lighting, parking lot lighting, or rooftop units, it's a pretty easy list. What's in it for you? You have recognition. The goal of these campaigns is pretty much to stand

and be counted. You can be recognized for showing leadership in energy efficient technology. You also have great opportunities for peer-to-peer learning and access to experts.

So, next slide is our Interior Lighting Campaign. These slides are gonna be made available, later, so I encourage folks to take a look at those, and read more about it. Definitely looking for projects related to troffer light replacement.

Next up is Advanced Rooftopping Campaign. This particularly is pertinent to retail locations. We partner with Retail Industry Leaders Association on this project. It's been very successful.

And then, finally, the LEEP campaign – lighting, energy, efficiency, and parking – which is just coming to an end, this year. Well, not coming to an end, I shouldn't say that. It's moving on from Department of Energy, and gonna be taken over by Green Parking Council, to keep this information available, to keep the recognition going, and make those experts available for more learning.

So, with that I'm going to go back to step three, which is the tech demos, and talk specifically about two technologies that are progressing through the technology pipeline, with real building demonstrations.

Holly, I will send it back to you to move us along.

Holly Carr: Thanks, Andy. Yeah, we are gonna move into the nuts and bolts of some of these new technologies, and their associated demonstration projects. Roberto, you're next up. Can you tell us a little bit about your experience, thus far, as a technology demonstration site, hosting Building IQ's product at the Allen Hospital?

Roberto Nunez: Yes, I can. Good afternoon, everyone. As stated before, my name is Roberto Nunez. I am the site director for facilities operation engineering at the Allen Hospital/Spine Hospital. We are 106 campuses, not counting our regional hospital network. As previously mentioned, also, is that I've been with NYP for over 12 years, at various positions, and I've worked in controls for over 17 years. Because of my experience in controls, I know there are many opportunities for energy savings via the building management system.

Can you skip two slides?

The building managing and system energy savings opportunities are important to a variety of groups – facility engineers, property managers, or organizations just looking for significant energy savings. Energy management can be achieved through the building management system, in many ways. For most programs, systems focus primarily on air flow reduction, as most of you are familiar with.

Reducing air flow demand usually coincides with slowing down supply vent speeds, which reduces electrical consumption from your air handling units. The negative side of this process, unfortunately, is the possibility of affecting occupant comfort. In addition, in critical care environments such as healthcare, if air flow or pressure is not properly controlled, infection control can be compromised, and the occupants can be adversely affected.

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Although the building management system offers many opportunities, its output capability is limited to the programming, data, and parameters provided by the installers and owners. Broad airflow and temperature set point ranges are used to provide adequate conditions for building occupants. Because of this, most systems do not respond efficiently to varying changes in the environment. I'm very sure most of you are aware of this, as well.

The Building IQ decision-making software serves as intelligence to the building management system. The intelligence enables the building management system to automatically update its set points according to sensible forecast created by the software algorithms. For any of you who already have an existing building management system, you understand that, even though you have preset parameters, you're constantly manually tweaking things, or overriding things, in order to get your required outcomes.

The building IQ software runs in conjunction with your building management system. The building management system continues as the backbone, while Building IQ actually runs in the background, continuing to analyze data from the weather and energy meters, along with building management system.

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As you can see, these are many of the Building IQ interface points. Building IQ uses a diverse mix of interface points to provide data

to the algorithms, determine the appropriate supply air temperature and static pressure set points. Building IQ measures and validates these data points for a specified period of time, creating a building profile. So, better map your building points.

Next slide, please?

As you see, the Building IQ software algorithms continually model, learn, and relearn the unique behaviors of the building. The data is communicated minute by minute to the call server, where analysis and subtle changes are made, if needed, to the supplier or static pressure supply points. Engineers are watching daily, and reporting results monthly, for customer review.

As you can see, it synthesizes the data software communications cooperation forecasts to the building management system, which the BMS automatically acts upon. Resulting in net drop in system demand, without sacrificing occupant comfort, which is a key factor.

Next slide?

As you can see, Building IQ calls this process the Predictive Energy Optimization. Building Predictive Energy Optimization results in lower energy calls, without sacrificing occupant comfort.

Next slide?

Building IQ basically refers to their service as an advanced artificial intelligence algorithms, which learns and models the thermal characteristics of your building. It continuously learns by analyzing weather, energy, building management system data coming from the building. It also intelligently determines optimal sequences, temperature set points, and other relevant system parameters.

It automatically adapts to the changes in usage patterns, internal, or external conditions. As you know, different attributes of the building changes the way your system responds, so you have to make constant changes. Having the system automatically adapt to it makes you be more efficient, and are less headaches for all you building managers.

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As you can see, the Building IQ predictive analytics forecasts

future probabilities using current data and historical facts, to better understand risk and opportunities for your building. It extracts the data, determines patterns, and future outcomes and trends.

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As you can see, with the Building IQ, the predictive energy optimization tool benefits, the financial management tool, as you can see, reduces HVAC energy spends, creates cash in forms of savings. You can use the cash savings to finance other energy products, conserve the cash for the owners, avoid costs, and trim budgets, which is very important for all of us.

Energy management tool, as you can see, reduces HVAC energy consumption, reduces demand, reduces greenhouse gases, analyzes HVAC performance and dynamic energy usage, and continuous optimization. For all those who are currently involved with retrocommission, this is basically a continuous retrocommissioning tool for your building management system.

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As you can see, this is just a profile of what you hope to expect from your system, after implementing the building IQ services. You have your average demand, and the average savings you see with the systems anywhere with 10 to 20 percent, conservatively.

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So, this is actual data that we have collected from the Allen Hospital. Basically, it's just showing a profile of one of the air-handler units, and all the information that it's collecting. Utilizing this information is how the algorithms implement the adjustments, so make sure that your system's operating at the most optimal parameters possible. And the process, also, using software, it takes all the information and updates it to their call server, that's why it's an ongoing monitoring service.

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As you can see with this profile, by utilizing the Building IQ service, you're minimizing or avoid drifts outside your temperature control limits. Which is the key aspect behind the service, and what we all wanna accomplish.

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As this power profile shows you, optimized temperature control looks much different. Noted that the shaded green areas, periods of HVAC saving during our drift periods. For the extra shot of cooling, we could see an increase in energy use. But the net total for the day is an overall savings in energy.

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This is an existing case study that was completed by Building IQ, in which they were able to achieve a 17 percent reduction in HVAC spend. We are conservatively predicting 10 to 20 percent energy savings at the Allen Hospital. This would translate, just for our campus alone, anywhere from, $220,000.00 to $440,000.00 savings per year.

Once we implement this out throughout the organization, this would translate to millions of dollars in energy savings per year, for us. That's how much an opportunity this is, for us.

Next slide?

This Building IQ portal building visualization is basically a profile of the data information they can provide to you once you implement this service.

Next slide?

As you can see, these are the many customers they currently have on their list, and we're one of the many high profile names they have.

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In summary, I just wanna state that, combining the advanced machine data and analytic and predictive modeling, to deliver intelligent automated optimization of HVAC, maintaining comfort, this is, as you can see, a proven 10 to 25 percent HVAC energy savings. And up to 20 percent peak load reductions during demand response, which I didn't really cover, but it's a great opportunity. And, as you can see, is also backed by industry leading vendors, and partnered with US and Australia National Labs.

And seeing as my time's running up, I can close up, and I'll pass it on to the next presenter.

Holly Carr: Okay, thanks very much. Appreciated, Roberto. Sounds like a great initial interaction with Building IQ, and getting the technology going at NYP. So, thank you very much for both participating in this demo.

I should mention that New York Presbyterian Hospital is also a Better Buildings Challenge partner. It's been a partner for quite some time and, actually, that's how this demo came to fruition. Is that we do typically publicize our technology demonstration opportunities with our Better Buildings partners first, in the Alliance and the Challenge. So, thank you very much.

I'd like to remind our audience that we are collecting questions through that chat box on your webinar screen. We will have a time for a Q&A period at the end of the session. So, please go ahead and send those in.

And I'd like to move, next, to Udi at enVerid. Udi, can you tell us about enVerid, how these intelligent scrubbers work, and a little bit more about the associated energy reductions that we're seeing in demonstration sites?

Udi Meirav: Yeah, gladly. And thank you, Holly, very much, for including us in this webinar. And for all the audience, for taking your time to listen to what we have to say.

Let's jump one more slide forward, please.

So, this will come as no surprise to everybody, but buildings use a lot of energy, specifically for the purpose of managing indoor air quality. And the way that comes to bear is that we constantly bring in outside air into the building, and reject the air that's inside the building, through exhaust. That is done for a very specific purpose, which is to remove from the building what's called molecular contaminants.

So, unlike dust particles and germs that can be dealt with directly, molecular contaminants – which is carbon dioxide, formaldehyde, and other VOCs – the only way buildings know how to deal with them is, essentially, by replacing the indoor air with air from the outside. That's the universal practice, which is in every commercial building, but it costs a lot of energy.

The main reason it costs energy is because you're bringing outside air, which is always at the wrong temperature. It's either too cold in winter, or too hot and humid in the summer. In both cases, we're

substantially increasing the energy load on the HVAC systems, through this process of outside air.

Let's jump to the next slide.

So, the idea behind enVerid's offering is very simple: let's not do that. Let's not throw all this air outside. Let's keep it indoors, clean it, and recycle it. Essentially, if we had a technology that could efficiently remove these molecular contaminants, then we wouldn't have to throw out this air and bring in these large amounts of outside air into the building. And we would benefit with the lower energy costs, lower loads on the HVAC systems, and quite often end up with even better indoor air quality.

So that's the whole big idea, and that's what brought to us the concept of the HLR, which is the next slide.

So, we call it HLR, which stands for HVAC Load Reduction. It's essentially a network of smart indoor air scrubbers that we can install in the building. It can be installed as a retrofit. You have a picture of one of those units, here on the slide. But let me focus a little bit on the cartoon, here, on the left side, and explain how this works.

The unit, essentially, does not get in line with the main airflow, but you put it side by side next to your HVAC air handlers. Or, in fact, you can put it in the return air plenum. It sucks in air from the return air line or the plenum. Inside the unit, the air comes into contact with a specialized blend of novel sorbent materials. These materials, which were invented and developed in the process of making this technology real, are designed to capture all the range of indoor air molecular contaminants. So that the air, after it passes through the HLR, comes out clean. And it's basically reintroduced back into circulation.

Now, the unit needs to be cleaned, because, as it accumulates these molecular contaminants, eventually it gets saturated. So, a couple of times a day, it goes through a self-cleaning process, where it essentially closes itself off from indoor circulation, takes warm air which is brought from the outside of the building, and flushes the sorbent materials. And after doing that for about half-an-hour, the sorbent material is clean, the contaminants are exhausted outside the building, and the unit is ready to start another cycle. It can do this in a period fashion indefinitely. It can go like this for months and years.

While it does this, it also handles the reduction of the outside air inlet, by taking control over the electromechanical damper that manages the outside air inlet into the HU. So, you get the combined function of cleaning the indoor air and reducing the outside air introduction to the building. And all of this is managed by very sophisticated software that sits on servers and communicates, in a wireless fashion, with all these units that are installed in the building.

Let's move on to the next slide.

So, the idea is simple. The technology is fairly sophisticated, in terms of material science, electronics, and mechanical. But it raises the question, "Why is it now? Why do we have this technology now, and not, maybe, 10 or 20 years ago?" And it's kind of interesting. There's a convergence, here, of multiple things that have come together to make it, now, the time for deploying a technology like this in commercial buildings.

The fundamental concepts of cleaning indoor air from these molecular contaminants evolved in the development of manned space travel – like, space stations and space shuttles, where there is no opportunity of bringing in fresh outside air to the unit – and these concepts were initially developed there.

In addition, there's been tremendous progress, in the last 20 years, on sorbents. Especially sorbents for capturing carbon dioxide, because carbon dioxide has been a contaminant of outside air. And the increase in CO2 levels has led to tremendous amount of investment and research in better ways to capture carbon dioxide from the air, which has indirectly benefited the development of this indoor air treatment technology.

And, finally, there's been evolution of the regulatory landscape. ASHRAE, in the last decade, has introduced alternative paths to managing indoor air quality. That allow for the building owner to, instead of replacing the outside air at a fixed amount, manage indoor air quality to air quality targets, without necessarily having to bring those amounts of air into the building.

So it's the collection of these three factors that have brought about, today, what we call the HLR technology, that we are now offering to buildings around the country.

Let's get to the next slide.

So, let's talk a little bit about the benefits. The units can be retrofitted essentially in any building. You can put it on the roof, if you have rooftop units. You can put it in a mechanical room, in a plenum.

Typically, what you find is about 20 percent reduction in the energy usage of the HVAC systems, worldwide, yearlong. The impact is much larger during the peak season. Especially in the heat of summer, you can see impacts of 40 percent. And we've seen even 50 percent reductions in the power load on the chillers in hot climates. When you aggregate over the course of the year, you see a retrofit payback of about one-and-a-half, two years, sometimes three years.

When you talk about new construction, the benefit is even greater. In the sense that you can reduce the overall size of your chiller plants and your other infrastructure, because the peak load is reduced. And, typically, your systems are set for peak load.

Other benefits include, also, improvement in indoor air quality. Especially when the outside air is not very good, that's when bringing less outside air into the building actually benefits you, with improved indoor air quality and longer lifetime for the HVAC's filters, that don't have to deal with so much outside air.

Next slide, please.

So, here's a case study, a recent installation we've done in Miami, in the University of Miami Wellness Center. One of the interesting things about this technology is it's very easy to demonstrate its benefit. Because once we have it installed, we can turn it on for a week and then turn it off for a week – or, fact, day by day – and do direct comparisons. Both of the energy consumption and the measured air quality in the building, in the on days and the off days. So it gives us very clean, isolated signal of what the benefit is.

What you're seeing here, is, the green bars show the performance when the unit is on, and the blue bars when the unit is off. You can see about 29 percent improvement in the energy consumption. And significant improvement, actually, in all measures of air quality, despite the fact that we're bringing in a lot less fresh air into the building. This demonstration just started this last summer. We'll keep doing it, now, for the next year, year-and-a-half. And it's sponsored by the DOE, the HID program, which we're very appreciative of.

Let's just jump to the last slide, 'cause my time's running out.

I just wanna point out, we're now getting recognized by many organizations that care about these things. ASHRAE has officially recognized that this approach to air quality is legitimate and sanctioned. The Green Building Council is giving LEED points. One of our customers got nine LEED points, for deploying our technology. The GSA has a demonstration running right now. We're working closely with Johnson Controls. And we even got the 2015 Frost Sullivan Award for the best practice in HVAC – the most innovative company in the HVAC arena.

So, that's my story, today, and thank you, again, for your attention. I'm happy to take more questions.

Holly Carr: Thank you, Udi. Great explanation of what's going on inside this box, and explanation of what is a pretty complex product functioning in our demonstration buildings.

Thanks to all of our audience members who are sending in questions. They're just rolling in, here, and we're gonna get these to as many of our panelists as we can.

Before we do that, I'd like to move to the next slide, please. And I think we'll move to the next slide, on this one. Thanks.

So, this is the link, at the very top here, just a little bit more information from each of our three panelists. The link at the top, from US Department of Energy, is the High Impact Technology Hub that was mentioned by Andy. So, if you are interested in demoing technologies with us, check out the Hub. That's where we are always listing demonstration opportunities with our HIT Catalyst program.

We also list those on the Better Buildings newsletters that come out to our partners. So, if you are a Better Buildings Alliance member, or a Challenge member, be sure to check out the Better Buildings bulletin for those tech demonstration opportunities. If you're not yet involved with Better Buildings, get involved with us, so you can follow that, as well.

A couple of items from New York Presbyterian Hospital. I mentioned that NYP is a Better Buildings Challenge member, so just wanted to highlight a case study that they have already done with us, their Gallery Walks Implementation Model. Talking about

their strategies from an organizational perspective, for how they are getting to the 20 percent portfolio-wide building energy savings that they have committed to through the challenge.

So, you know, today, we're talking about Building IQ as one of the technical strategies that they are using to get there. But the gallery walks case study talks about organizational strategies, and how they're really engaging their own stuff. To be a part of the energy savings opportunities, and to submit and look for energy savings opportunities in their daily jobs.

And then, finally, a link from enVerid, with more information about the technology. We've had a number of questions about how the systems work, and we'll try to get to as many of those as we can, but check out this specific link for more detail on the enVerid technology.

So let's go ahead to the Q&A portion of our conversation. Let's see, here – where should we begin? *[Laughs]*

Roberto, we have a question for you, just on the relationship between the host site and the technology company. So, wondering what interaction your facilities team has had with Building IQ. And getting started on the tech demonstration, and throughout the demonstration period. And, also, question about fees associated with the software, and if it's an ongoing subscription, or if it's a box that you purchase and use. So, can you take that one, for us?

Robeto Nunez: Not a problem. Yeah, so, basically, I've been working hand-in-hand with Building IQ, implementing the software. Working at a healthcare facility, we work with a very tight, secured IT network, so getting'em access and setting'em up. So it's been, initially, a little more difficult than some of the other areas, because of our IT process, but we've been working hand-in-hand.

Building IQ is basically a service. So, basically, you're paying for an ongoing service, because it's 24/7 operations, and it's constantly monitoring your system, to make tweaks and change to make sure you're running optimally. So the service calculation is based on how much they're – it's basically, you're expecting to have a certain amount of savings, so it usually comes out to a percentage of that.

Holly Carr: We had a couple of follow on questions, wondering if the Building IQ service can be adapted to communicate with energy storage software, or to identify peak loads. *[Crosstalk]* React to that.

Roberto Nunez: Yeah, so, to my knowledge, we already have an existing curtailment service. But one of the things, once Building IQ is fully implemented, and once they have a full building profile, they can actually act as a peak demand system. And I believe they can work with existing software, as well. Unfortunately, I'm not – I know what they've done for me, and I'm briefly knowledgeable on some of the other services they have. But to my knowledge, I believe it does work with other systems, since we have one already in place, as well.

Holly Carr: Great, and a point of clarification on your HVAC equipment. So, you took Building IQ and added it to your existing HVAC equipment, right? You didn't put in new equipment before or in conjunction with this.

Roberto Nunez: That is correct, so it's basically all my existing building HVAC equipment, existing building management system. Building IQ basically puts a small device head in to collect the data, and depending on the type of implementation, you might have a couple additional meters installed. But other than that, that's it. No additional HVAC equipment is installed in order for their service to be implemented.

Holly Carr: Okay. My guess is that you don't know the answer to this question.

[Laughter]

But we have an audience member wondering if Building IQ has been deployed in Hawaii or other Caribbean countries – that sort of climate. Do you happen to know that?

Roberto Nunez: I don't know specifically about Caribbean countries. But I do know they're international, so I would tend to guess the answer yes. But I don't know specifically of any Caribbean countries they're working in now.

Holly Carr: Okay, great. And I'm gonna turn to Udi for just a second, with some questions about the specifics of the HLR. We have an audience member wondering how the molecular contaminant removal of the efficiency of the HLR is determined? And, you know, over time, if the sorbents are used up? And how you know when the efficiency is degraded? I would assume that, if you're testing the contaminants in the air and you start to see a rise in that, then you know something needs to be replaced?

Udi Meirav: Well, yeah, so there's three pieces, here. One of them is monitoring the air quality. We have built-in sensors. Not one, but multiple sensors in different points in the HLR, at the input and the output of the HLR. So we are not only monitoring the building indoor air parameters at all times – and, by the way, these are specialized sensors that we've developed for the HLR. They address VOCs and CO2, as well, of course, as temperature and humidity.

But we also look at the input and the output and compare the two, and I think the audience person is alluding to that. So, by comparing the input and the output of the HLR, we can tell what efficiency the sorbents still have in them in terms of the removal. So if you're coming in with a certain amount of contaminants, and the output you have a 90 percent reduction, that's pretty good. If there's only ten percent reduction, that's an indicator that the sorbent is approaching its saturation point.

That's one of the inputs that the unit software takes in, to decide when to run a regeneration cycle. Which is what I was explaining before, when we close off the circulation to the building into the HLR, heat up the HLR, and flush it, and that kind of regenerates the sorbent materials. This happens, typically, a few times a day. The sorbents reach saturation – typically, it's carbon dioxide saturation – a few times a day, and we run this regeneration. But like I said, the sensors are a very important part of the technology.

One last comment. Over months, there is a slow degradation in the potency of the sorbents. For that reason, once a year, we replace the sorbents in the unit. So, once a year – it's like replacing the filters in an air handler – we come in – the sorbents are basically these cartridges that look a little bit like filters – we pull them out, put in new ones, and that is the annual maintenance cycle for the HLR.

Holly Carr: Okay, that's really helpful. We had a couple of questions about maintenance and what needs to replaced when, if ever.

Also had a question regarding retrofit versus new construction, if this is an equally effective solution or new construction, versus retro?

Udi Meirav: It's definitely effective for both of them. The fundamental air balance and the air quality issues are not really different. It's always easier in new construction, because if you design it in, it leaves less guesswork. Which is where to put the unit, and how to connect it, and make sure that you have the electric power right

next to where you want the unit. If you're doing retrofit, you have to go in and figure out where exactly in the mechanical room it's gonna fit, and you gotta bring an electrician to put wire.

So, it's a slightly bigger undertaking to do a retrofit in that regard, but, frankly, it's not that hard. I mean, this is a plug-and-play unit – you bring it in, power it up, and it's ready to go. We like to call it a plug-and-play system. So, it will work equally well in both. The only other thing I would say is that, in new construction, in principal, if you design the building with the HLRs, you can actually reduce the tonnage of your chillers. And that can be a small or a very large benefit, depending on the situation.

In buildings where there's, for example, ground loop heat pumps – we've had one customer where the capital saving, because of the peak reduction, was enormous. That by itself more than paid for the installation of the HLRs.

Holly Carr: And a kind of similar question that we had for Building IQ, is there a climate zone where this looks like it's working better or worse *[laughs]* than other places? Or is this solution pretty much climate agnostic, if you will?

[Brief pause]

Sorry, that was for Udi.

Udi Meirav: Oh, I'm sorry, I thought that was for Building IQ. Is that for me, the question?

Holly Carr: That's for you, yeah.

Udi Meirav: Well, it works in all climates. The first generation systems that we had worked only in air conditioning – in summer or in cooling mode. The new generation systems that we just have come out with, they operate both winter and summer. So they will save heating energy in the winter, and cooling energy in the summer. The energy savings is larger the more extreme the climate is. So, we find the best –

I would say the shortest payback, typically, will come either when you're in areas with very long, hot summers, or very deep and long winters. If you have kind of a temperate climate, the payback is longer, simply because there's less energy to be saved. But the system will operate, essentially, in any climate.

Holly Carr: Great. We have, I can tell, a few LEED specialists on the line, interested in if and how the system helps to meet ASHRAE 62.1 indoor air requirements?

Udi Meirav: Yeah, so, ASHRAE 62.1 IAQP allows buildings to manage indoor air quality without, necessarily, a prescribed amount of outside air. So, as long as you monitor what's called the contaminants of concern. I will say that, it's a fairly complex topic, so I cannot really address it in depth, right now. But we have engaged deeply with both ASHRAE and with the US Green Building Council – with a lot of experts – on the topic. The news is very good. I mean, everything is extremely compatible and compliant with the code.

Part of our service, as we install these as retrofits, is to make sure all the Is are dotted and Ts are crossed in terms of meeting the requirements of the ASHRAE IAQP. It's not super hard, once you've done it a few times and you know how to do it. But for building owners who've never done it before, it is a little bit of an intimidating process. So part of what we do is we really make that – we take the pain out of that, if you will.

One final comment I will say is that ASHRAE's IAQP is evolving. I just learned, last week, that there's gonna be additional discussions, in this coming AHR meeting, where they will look for further ways to simplify the IQ procedure, so that it is more broadly adopted. And we're on top of those things, all the time.

Holly Carr: Great, thank you. And we had one final question about residential applications, if you've used this, at all, in residential, or primarily commercial?

Udi Meirav: So, you know, in the vast, vast majority of residential applications, there is not an intentional or a controlled inlet of outside air into the house, or the apartment. So, there's really not an opportunity to reduce the outside air intake, and thereby save energy. So, as an energy savings device for residential markets in the United States, it's not really currently on the agenda.

What we are seeing, though, is there are many residential applications where there's an air quality issue. Frankly, more outside the US than in the US. But in these markets, where there is an air quality challenge, the value of this technology is as an air quality improvement device. And we see tremendous demand for that, in some key markets.

Holly Carr: Great, thanks very much, Udi.

One question for you, Andy – probably our parting question for our audience – is, what, if any, technology demonstration opportunities are there right now? And what do you anticipate coming down the pike?

Andrew Mitchell: Okay, great question. You can find that information on the links that we've provided. On the High Impact Technology Hub, there's a section called "Host a Site." And if you click through the slides you'll see there's three technology areas that we're focused on right now, and we're looking for buildings with specific characteristics relating to those.

So, for a modular HVAC load reduction, with smart scrubbers – if that sounds familiar, Udi?

[Laughter]

Udi Meirav: It does.

[Laughter]

Andrew Mitchell: *[Crosstalk]* look for office, education, retail spaces, airport terminals, things like that, that would benefit from that technology. We also have a tech demo, forthcoming, focused on air variables, and sprayable liquid flashing – that would be new construction. And then, alternative and low global warming potential refrigerants – that would be groceries, supermarkets, warehouses with refrigeration systems. And, again, all those are available on our website.

In terms of what is coming down the pipe, we will have more focus on energy management systems, in general. We have a project going in the Northeast that is focused on lighting control, so things like motion detectors, daylight sensors, daylight harvesting, things like that.

So, definitely this is a dynamic and changing site, the High Impact Technology Hub. So I encourage people to keep in touch with us, keep an eye on the site. Again, join Better Buildings to be kept up-to-speed on what's going on. And we look forward to many more technology demonstrations, in the future.

I think that covers it.

Holly Carr: Yes, thank you, Andy. And, Kendall, can you run back to our "Accelerate Performance" slide? I wanna get this in here, right now. This is an initiative funded through Department of Energy, in conjunction with Seventh Wave, looking for a participant for a new construction initiative.

So, if you are interested in – particularly if you're looking at zero energy buildings, and working on or designing of your energy building, and might be interested in technical assistance, and perhaps financial incentives, to help you work through a construction and procurement process, that we think can be beneficial to zero energy buildings – please touch base with Seventh Wave.

The website is listed, down there, on the bottom. Seventh Wave is both a Better Buildings Affiliate, as well as a FOA – Funding Opportunity Awardee. We'd love to get folks involved, who might be in predesign with a new building and could take advantage of this opportunity.

So, with that, let's head to the very end, Kendall.

I just wanna give you a heads up for our next webinar, which will be Tuesday, February the 2nd, from 3:00 to 4:00 PM. We'll be focused on water efficiency, and how that can drive energy savings.

We have a nice broad spectrum of presenters. United Technologies Corporation UTC will be presenting from the industrial side. The city of Atlanta will be talking about their water reduction efforts in the city's infrastructure. And then, also, Better Buildings Challenge partner InterContinental Hotels Group – IHG – will be talking about their worldwide efforts to reduce water in their hotels, and also working with their franchisees.

So, please register for that. We hope you can join us for the February webinar.

And with that, I'd really like to thank our three panelists, today, very much, for taking time to be with us and talk to us about your technologies and your programs.

Let's move on to the next slide, where you'll have contact information for our panelists. If you have specific questions, or you're interested to demo the enVerid system, in your building, please feel free to reach out to our panelists, with any additional

questions.

And let's go back one slide, to the Better Buildings Summit. We, of course, wanna put in a plug for our upcoming summit, which is May 9th through the 11th, here in Washington D.C. Registration is now open for that event, and you will be hearing more about these technologies, at the summit. We'll have a really wonderful slate of panels and presentations and events for you, so we hope you can join us, there.

Of course, as always, keep up-to-date on all of the happenings in the Better Buildings Imitative, by following us on Twitter and signing up for the Better Buildings Bulletin, our newsletter that comes out once a month.

Yu will receive an e-mail notice, when the archive of this session is available online.

And thank you very much for taking time to join us, today. Take care, everybody. Bye-bye.

[End of Audio]