

Cindy Zhu:

Hi, good afternoon, everyone. I'm Cindy Zhu with the U.S. Department of Energy's Better Buildings Initiative. I'd like to welcome you to the March edition of our 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 are excited to focus this webinar on energy efficiency and the role that buildings play in human health and wellness.

The buildings in which we live, work and play have a direct impact on our mental and physical health. This webinar will showcase Better Buildings partners who are implementing design strategies and benchmarks in their buildings and sustainability plans that focus on the wellness, health and productivity of the people inside them. Before we get started with our presentations, I want to remind our audience that we will hold discussion questions until near the end of the hour.

We will be discussing some research results as well, so if you have any clarifying questions along the way, please use the chat box, and we'll try to answer them. Please put your questions through the chat box on your webinar screen throughout the session today, and we'll try to get to as many of them as we can. The session will be archived and posted to our Better Buildings Solution Center for your reference. Next slide, please. We have a great trio of speakers today who will lend their expertise on several aspects of buildings and health.

Our first speaker, Beth Hawkins, is co-founder and vice president of Three Cubed, a nonprofit research organization that is focusing on state and regional studies that assess and monetize the health and household-related impacts of energy efficiency programs in several states in the Northwest and Midwest U.S.

Our second speaker, Sara Neff, is senior vice president at Kilroy Realty, a Better Buildings Alliance partner. Since Sara started at Kilroy, they went from having no sustainability program to being named the number one publicly traded office real estate company on sustainability in North America, by the Global Real Estate Sustainability benchmark, and under her leadership, the company recently committed to becoming the first carbon-neutral real estate company in North America by the end of 2020.

Our final speaker, Megan O'Neil, is the energy program manager for the City of Atlanta, Mayor's Office of Resilience, focusing on renewable energy, energy efficiency and water efficiency policies

and projects. The City of Atlanta is a Better Buildings Challenge partner that has a goal of transitioning to 100 percent clean energy by 2035. So now let's get started and hear from our first panelist, Beth Hawkins, who will share research results about how weatherization programs directly impacts on health and wellness of residents in single-family and multifamily housing. So next slide. And take it away, Beth.

Beth Hawkins:

Hi, greetings, everyone; thanks for joining us today. Thanks for the introduction, and I think you can go ahead and advance to the next slide. Thank you. I'm gonna kick off the webinar with a story, and I'm speculating that many of you are familiar with it. The characters in the story are real people. They are our disadvantaged population that suffers disproportionately from health disparities, and the people in today's story live in affordable multifamily buildings.

So if the building that they call home gets weatherized, will their lives change? Will their health and well-being improve? Do residents of weatherized multifamily buildings experience the same type and magnitude of non-energy impacts than single-family residents? Today I appreciate the opportunity to share select findings from our studies that will inform the study – sorry, the story. Next slide. But first I want to acknowledge who funded our project: the JPB Foundation and the Utility Program Administrators in the State of Massachusetts.

I have the best team on the planet, in my opinion; that's Bruce and Erin and Michaela here at Three Cubed; Slipstream, previously known as Seventh Wave; the MMR Group; and the University of Tennessee here in Knoxville. The contributors that we have listed here made this work possible, and we are super-grateful. Next slide. So I know you wanna kinda get to the juicy stuff, the evidence that I need to provide some context, so I'll just give you a very brief overview of our client multifamily project.

I'll not be discussing technology and all those research-y things on this webinar. I will present a graphic that helps conceptualize the connection between weatherization and the direct and indirect impacts on life and health and well-being, and then I will show some results that take the story home. Oh, and before we move on, please note that these results are preliminary and have not been fully vetted by our sponsors, so please do not cite any of the figures at this time. Next slide, please.

So our goal for this project is to assess and monetize the health-related NEIs of multifamily weatherization. We, and many others, really, have conducted NEI research in the single-family space, but not so much in the multifamily space. So our hypothesis is that even though occupants of single-family housing experience the same social determinants of health and well-being than those that reside in multifamily buildings, their structures, one, behave differently from the building science perspective, two, often contain different building systems, and three, typically different weatherization measures are installed.

So therefore, NEIs experienced by multifamily residents will likely vary in impact from NEIs experienced from single-family residents. So our sampling includes affordable multifamily buildings containing five-plus units scattered throughout the Midwest and the Northeast, with a large concentration in Massachusetts. The eligible buildings fit into one of the following three sample groups.

One, those that have already been weatherized, the comparison with treatment group – we refer to them as the CwT group; the second group, those that will soon be weatherized – the treatment group; and the third will not be weatherized, and so they serve as our control, and we refer to them as the C group. Next slide, please. So the key components of this study are as follows. The cornerstone of the project is the resident survey, which addresses health, budget, apartment conditions and community resilience, and through these results, we will monetize the multifamily NEIs.

In phase two, which starts summer-ish of this year and extends to March 2020, we will administer a follow-up resident survey, where we aim to compare the pre and the post for the same households. So we are also surveying property managers to capture building systems resilience benefits for identifiable opportunities, and interview property owners to gain insights on multifamily weatherization process. I will not be presenting anything from those compartments today.

Data With a Soul – this is a qualitative component that captures the human story through interviews with occupants, and we are currently in the process of identifying candidates to interview for this component. Next slide, please. So these quotes are from single-family residents that are participating in another evaluation that we're conducting of an energy efficiency program delivered by TVA in the Southeast.

So I'm sharing these personal stories from single-family residents not only because they are impactful, but what these anecdotes tell us, as I mentioned earlier, the income-eligible demographic, whether they reside multifamily or single-family, kinda suffer from the same social determinants of health and well-being, and we can substantiate this hypothesis with our results. Just thought I'd pause just a second, so you guys can read some of those. Next slide, please.

Okay. So this is a graphic that has helped us map out the connection between weatherization and direct and indirect impacts on occupant health, well-being and budget issues in general. This graphic is not necessarily my favorite for presentations, as it's quite wordy, but I'll walk you through and we'll just follow the one pathway. So at the top left corner, you see a box with common weatherization measures, and of course, not all households get the whole suite of measures, and measures are not installed at the same rate multifamily or single family, and vice versa.

Sorry – as a result, the structure, the building structure, has ideally been improved. So let's focus on improved thermal performance, number two in the bottom left box. So improved thermal performance directly improves health, as folks experience less medical conditions associated with thermal stress. Which, as we know, in extreme conditions can actually be fatal, so not only did we potentially avoid a death, but the need for medical treatment for thermal stress has decreased.

With improved health, less time spent at the doctor or the emergency room, a person might end up not missing as many days of work, which, if you don't receive sick pay, you lose work, and you lose money. Next slide, please. So this slide characterizes our sample population, so all this is good information, so we as researchers can compare the compatibility between groups and look for variables that might influence your compounded results.

But what I really wanna point out to you all on this slide are the Ns, the sample sizes that are presented at the top in the dark blue row. Not too shabby, in my opinion. The next slide, please. So for the remainder of this presentation, I will reveal results from the resident survey, as I mentioned earlier; 1,660 households, representing 2,448 persons, and 361 buildings. Please note that the preliminary results from phase 1 are comparisons between the CwT group, serving as the weatherized group, and the T plus C group, representing collectively the unweatherized group.

So when we receive things **to that with NEIs and clearly** compare the results pre/post for the same household. Next slide. So these are some data points that tell the story from improved **value** quality attributable to low income weatherization to observed outcomes, to NEIs, so let's go left to right, the top row first. So imagine Grandmother Jones living in a building that is very drafty, which is contributing to her apartment being at an unsafe temperature.

The thermal performance is inadequate due to, say, poor insulation and large cracks around the windows. Her heating system is about 100 years old and inefficient and ineffective. She's struggling to pay her energy bill, meanwhile using her oven to heat her home and to stay at a safe temperature. And now let's add a bit of mold, possibly due to the dampness coming through the cracks, and let's also add a grandchild with asthma.

So the values represent the degree of change between pre/post, so post-weatherization, we see a decrease in indicators of inadequate housing that had direct impacts on health, and many of these are at a statistically significant level. Okay, so if you could take a look at the bottom row now, so due to all the improvements, Grandmother Jones and/or her neighbors potentially experience a decrease in number of emergency department and non-urgent care visits due to exposure to extreme cold. Skip that middle one just for a second.

So the grandchild with asthma and any asthmatic neighbors may experience a mean decrease in number of emergency department and hospitalizations from a decrease in asthma flare-ups. Scooting back to the not eating data point, we ask the following question: in the past four weeks, did you or any household member go a whole day and night without eating anything because there was not enough food? So I said earlier, many of us are familiar with this story.

These NEIs that I just discussed here are the usual suspects, and the connection with weatherization really passes the lab test, as my team says. Next slide. But then we have these potential NEIs that are not as familiar to us. These are the ones that do not immediately cause us to think, "All right, of course, sure." So when we were designing our survey instrument, we wanted to explore additional health conditions and associated symptoms that have a potential to be impacted by improving dwelling quality through weatherization.

So these four are pretty interesting, I think, and observed for the research, so we're not making the case that weatherization cures

these conditions, but that it can decrease the frequency and perhaps the severity of symptoms. We can see with this data right here that post-weatherization there's a drop. Next slide, please. Okay. So now these would be outcomes that we believe have the potential to improve Grandmother Jones' sense of well-being and her quality of life, as well as her grandchild and neighbors.

I mean, it makes sense that these outcomes could improve well-being. I mean, like less rodent infestation, feeling safer on the property, perhaps in part because there was improved lighting. The apartment does not very often have unpleasant odors seeping into the space from the outside, and perhaps even sleep better without as many noise disturbances because that outdoor noise pollution has decreased. Next slide. So in the previous slide, we saw evidence that outdoor noise pollution can be reduced by weatherization.

Furthermore, number of poor sleep days has decreased; to remove the confusing double negative, an increase in number of days of quality sleep. The number of days mental health was "not good" has decreased, as well as the number of days our respondents' activities were limited due to poor health. So the chart on the right presents questions that have the potential to influence community resilience outcomes, specifically social cohesion. Social cohesion is a predicting factor for community preparedness through a willingness to help neighbors during times of crisis.

So if weatherization can increase the resilience of residents of multifamily buildings in the face of extreme events, or even just the constant daily stresses that were pressing down on them, we really need to think about weatherization as way more than an energy program, but a health and wellness program. Next slide.

So in conclusion, initial analysis does suggest that there are multifamily NEIs attributable to weatherization. We have seen through our other single-family NEI studies that our occupants of single-family housing experience the same social determinants of health and well-being as those that reside in multifamily buildings, but the NEIs have been showing varying impact from single-family NEIs and should not be generalized to multifamily buildings.

So lastly, as we saw in the previous slide, the multifamily system provides opportunities to contribute social cohesion and community resilience. And the end – thank you for your attention.

- Cindy Zhu:* Thank you, Beth. That was a really great visualization of some of the things that a lot of us already know about buildings and health, but it's just very striking to see that, those comparisons on the screen. So a quick question that we have for you; someone asked when the final study will be published, and where it can be found.
- Beth Hawkins:* It will not be published until 2020, which seems like a long way away, but really it's not, and we will – then we'll have it posted on our website, and we will be discussing where we will disseminate the report. So there's that answer.
- Cindy Zhu:* Okay, great. So let's go to the next slide. Now we will hear from our next presenter, Sara Neff. So Sara, tell us how a landlord like Kilroy Realty is working on issues of health and wellness in commercial offices?
- Sara Neff:* Absolutely. Thank you so much to Cindy and all the rest of the Better Building Challenge team for having me. So Cindy said I'm gonna go through how – what general health looks like in commercial real estate, and how we're implementing our health projects and features and programs in our portfolio. I just wanna give a little sense of my company, for those who aren't familiar with us. Kilroy Realty is a West Coast real estate investment trust, publicly traded, and we own about 14 million square feet of mostly office space.
- Little bit of life science, one residential tower, which I'll just talk about later, and some retail to support mixed use projects. And we are primarily active on the West Coast, and we are – a long-term hold tends to be our business model, and that will also come into play later. Okay. Next slide. Skip over this – you guys know what I'm gonna say. All right, so I just wanna start this off with a story to just sort of show why health in the building environment is important to me.
- So when she was two, my daughter **Laura**, pictured here, started coughing herself to sleep every single night, and it wasn't going away. She'd always been the sicker of our two kids, you know, the one with the endless colds and the ear infections and trips to doctor and stuff, so we just thought the cough was just one more thing. But it wasn't going away so we took her to the doctor, and she started putting her on the breathing treatment that you see here, and that wasn't working, and steroids got added; it wasn't working, and it was just agonizing.
- And then only six months later, when she was diagnosed with asthma, was it the first time I thought, "Oh my goodness, I wonder

if it's something about the air in our house –" we live pretty close to a busy freeway. And we got an air filter, and the problem was gone in two days, and she hasn't coughed herself to sleep since. And I illustrate that story because I do this for a living – now I'm a green building professional. I mean, the connection between health and air quality and the _____ environment wasn't clear to me, and so this is a really tough concept for people to grasp.

Now, I do this every day, and yet my own home's impacts were not something that I was immediately grasping, and so that is one of the things that really spurred me to really ensure that my buildings at work are really, really promoting health. What does that look like? Next slide. So what that looks like is it's based on a lot of research. So we heard a fantastic, an absolutely fantastic presentation from Beth. Those are amazing results and I love those and I can't wait to highlight them.

We also read a whole lot of research at Kilroy. A major study is the cog effect study, otherwise known as The Impact of Green Buildings on Cognitive Function, out of _____. Stök did a great white paper on the financial case for high performance buildings. All right, so we really look at this research – not just my anecdotal experience in my own family, but the research around the world, basically showing there's these connections between health and productivity, and we wanna provide that for our tenants.

And I can actually make a little kind of announcement today: as of this morning, Kilroy is going to be participating in the newest cognitive effect study out of Harvard, which is putting a bunch of air sensors around offices and giving people Fitbits, and connecting how active and productive they are with the actual air quality at that time, so we're really excited to be participating. So this is a lot of the research we use when we were creating the foundation for our health program.

It really motivated us to create such a program. Next. And so here's what our basic – here's what our health program is. The cog effects study and others have shown that when carbon dioxide goes up, IQ goes down, and when carbon dioxide is down, IQ goes up. And so air quality is one of the two major tenets of our program, and I'll get into how we ensure good air quality later. Next. And the other part of our program is active design, so what health looks like in commercial real estate is a combination right now of two things.

It's good air quality and active design. I can talk about what active design is, but it's sort of intuitive; it's design features that make you

more active in the space, so this is an example. This illustration is from the Bullitt Center, which has a really fun staircase – I've taken it myself – they call it the irresistible stair. It makes you wanna get up and move around. One of the studies that have come out shows that taking two flights of stairs helps adults avoid most normal adult weight gain.

And so think of active design as a pedestrian-activated place where people can walk to work, or can bike to work, and are able to have sit/stand desks that are more active during the day and avoid back problems. So all of these things, we consider that active design. So good air quality, active design. Next. So this is what our health program looks like at Kilroy. Our health programs are split into three highly-overlapping areas: our employees, our tenants and our buildings.

I'm not gonna get too much into the employee wellness; other than the Fitbit study I was talking about earlier, most of that is run by human resources, and that's health insurance and other benefits, _____, that kind of thing. So I'm gonna talk us and our buildings, so a little bit of that's how we engage our tenants on health. Next. So as I said, active design, so here is _____ how we do active design and air quality in our building. So here's what active design looks like in a building; this is a development project we are working on in San Diego.

It has a lot of _____ looking people hanging around in it, but I wanna point out some features that these are very typical of Kilroy buildings. So first of all, we have there's a lot of bike access. There's these doors that make it easy to take your bike in. There's bike storage inside and outside. We see an activated outdoor space, so there's people working outside. They get a connection with the outdoors. There's a lot of research that shows a connection with the outdoors helps in productivity.

We make it really attractive to work inside and outside, and then you can see that there's a lot of glazing into the office space; that means that people have access to daylight and views. Next. Another thing that we love at Kilroy is our stairwells, and so these are two pictures from one of our buildings that went for Fitwel certification, which I'll talk about in a little bit.

And one of the things that Fitwel really rewards is activating your stairwells, and so we both put – in the elevator lobby, they have these what I think are very cute graphics that encourage people to take the stairs instead of the elevator. And also, when you're in the

stairwell there's – the stairwells are full of sort of these sort of motivational little phrases that people can look at, and also there's little figures that are moving around, and so it makes people really want to take the stairs.

Again, there's a lot of research showing that when you have activated stairwells, like we're finding, that people do take them. And I will say one of the unexpected benefits is a tall office tower has a lot of elevator traffic, and with more people taking the stairs, we've actually noticed that the elevator wait times are less, so that was an unexpected benefit that we were able to experience. Next. I just wanna talk about what bike storage looks like in commercial real estate.

It no longer looks like old _____ and bike racks in the parking garage. Now we talk about bike spas, so this is an example from a project in Seattle that has a – it's right on a major bike transit route, which we actually helped improve as part of the site improvement. And we expect a lot of people to be biking to this site, and so we have this really beautiful bike facility. It has signage, it's right on the ground floor, great, a lot of storage. There's also repair facilities in there.

So again, we're really seeing a whole lot of active design. Next. And the air quality monitoring. So this looks pretty boring, I have to admit, and this is what air quality monitoring looks like to me. Air quality monitoring looks like taking a lot of samples of the air in various buildings, and that's where we're at. We're at annual sampling. The current state of the market in commercial real estate is that sensor technology that will continuously monitor the air makes all the sense in the world.

There's a lot of people working on it. There's not a ton of adoption in commercial real estate. We'll actually be deploying our first continuous air sensors as a result of this _____ study. But right now, what commercial real estate is looking at is this annual testing. These are – and I swear I chose this at random – these are very good readings, so according to the cognitive study, you're looking for CO2 levels at or below 2500 parts per million.

The typical "good" office, California building codes, for example, will get you to 925 parts per million. But I will also say that like in my house, if we don't open the windows and actually are cooking dinner with the gas stove and everybody's breathing, we can go above 3,000, and then we actually go down because air quality's

something that we care about. I'm always opening the windows, and everybody's cold.

So air quality can range a whole lot, and very quickly, and so it's something that we really want to keep a close eye on, so annual air quality testing. Next. And then the other piece of this is healthy materials. So we have a building standards document that requires, both in the base buildings and then also requires of our tenants, that they maintain standards for healthy materials. I didn't wanna just pop a picture of a materials data sheet 'cause it just was a bunch of numbers.

So we also really encourage products that have achieved a health product declaration, where they really know what all of their health impacts are. But at the very minimum, we're looking for low or no VOC paints/adhesives, including _____ formaldehyde in any composite wood products. We're looking for carpets and hardwood floors. So that is also how we are maintaining a good air quality level within our spaces. Next.

And then I wanna talk a little bit about our tenants. So one of the things we do is we really try to engage our tenants on health. This is an example. This is a picture I snapped in my own building at a wellness fair we had last January, so you can see we invited people who are related to health from healthy food to ergonomics to other chiropractic stuff, exercise, gym memberships, are there, so the tenants can engage with giving out free massages.

The lady with the blonde hair – she's in the background – definitely came in to make us sign up for a farm share for fresh produce, which we still get. And so this is also something we wanted; we have active events with tenants, in addition to sort of impassively receiving the health benefits we have in our buildings. Another thing is we know that people like to feel connected to their communities.

We won't show a picture of it because people can be squeamish, but we also host blood drives in our building, and I think people really get a sense of community out of participating in those and other community events like that. And so those are ways we are connecting with our tenants. Also, buildings will do things ad hoc. We'll open up a vacancy if a tenant wants to use it for a yoga class. We'll create – if a tenant asks us to create like a little walking path around their campus, we put little mile markers in to know how long they walked.

They liked that, that was a really low-cost easy thing. So those are ways that we engage our tenants on health in the _____ environment. Next. And then we believe in certifications. We believe in certifications because I think (a) it holds you to a third-party standard, and it also provides that third-party validation that we're looking for, so we are big believers.

So our existing portfolio in Fitwel certification with 15 certifications – that actually gives us the most certifications of any non-government real estate owner in, I think in the world, that Fitwel just announced. And our goal is to get 40 percent of our portfolio Fitwel certified by the end of this year, so it was very much based on a whole lot of research around health and productivity, based on research out of the Centers for Disease Control and others.

I'm happy to answer questions around the Fitwel process when we have question time. And then the other thing we've done is we have a WELL certified building, so I mentioned earlier that we have a residential tower. We went ahead and certified that. We were one of the pilots for WELL for multifamily residential, and that was a lot more based on our – it was before people moved in, so it was based on construction practices, and a whole lot of air quality testing, water quality testing, all that good stuff.

So we also like to receive third-party validations for our health programs. Next. And I wanna talk a little bit about results. This is an article that the *L.A. Times* wrote about us for the health certification we've gotten for that residential tower. And one of the things that I wanna point out – and this is very busy, 'cause it's a screen shot – but the *L.A. Times* was at our building. He interviewed one of my sons about how he felt about being in the building.

And what he says is that he noticed that when he's in his apartment, allergies are nowhere near what they used to be, and he's actually experiencing positive health outcomes himself. And when people – I get asked about the ROI of health, and I shy away from that for a variety of buildings. For example, the Fitwel certification, it's quite difficult to get it for **various suburban assets**, because you know, a lot of research showing that single-car driving, long commutes are not particular good for you.

And that find that our more urban assets also often can have higher rents, and so **it'd be _____ if I can turn my** Fitwel and non-Fitwel buildings, and so I don't like to make financial case arguments.

What I will say is there's been a major reputational benefit through coverage in major publications like the *Los Angeles Times*. I do have investors asking about it, and we are figuring out – the investors just wanna know about like "health" without really knowing what metrics to ask for, and that's okay.

We're still in the early days in all this. It took the real estate industry a while to just figure out that health was – really active design and air quality are the things to care about. And so there will be metrics eventually, but I do get investor questions about it; they're very interested in it. But often what I say – they're like, "Oh, gee, what's the ROI?" I usually just say like, "What's the ROI of the holiday decorations in the lobby around Christmas?" And the answer is like there isn't one answer to those questions.

I feel the same way about this. To us, it's _____ like health is the right thing to do. We want your buildings to promote health because we want happy tenants that renew their leases or want to lease space in our buildings, and we just think it's what a responsible, forward-thinking landlord does. And so I'm gonna say like I think that's a little bit of a silly question, and we've been really able to find the value through a lot of very low-cost upgrades we think have really helped improve our buildings a lot and will improve the value of the building. Next. And that's it for me. I will turn it over to Megan.

Cindy Zhu:

Great. Thank you, Sara, and I already see a lot of good questions coming in, so we will get to that towards the end of the hour, and I'll just remind everyone to use the chat box on the screen. We'll continue collecting Q&A for later in the session. So finally, let's hear from Megan O'Neil on what the City of Atlanta is doing to improve wellness at a city scale.

Megan O'Neil:

Thank you, Cindy. Let's go ahead and go to the slide with the map on it of mine. So Atlanta is one of the 100 resilient cities in the Rockefeller Resilient Cities Network. When we talk about resilience with a city, we're talking about all of different inputs that go into what make our city, so that includes health, obviously safety, economic development, prosperity. And in our office, the Mayor's Office of Resilience, we place a really strong focus on clean energy and how the public health impacts in the city are tied to that. Next slide, please.

We define urban resilience as the capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow no matter what kinds of chronic stresses

and acute shocks they experience. In Atlanta, we have neighborhoods where childhood asthma were at epidemic levels, and that is a chronic stress that is something that can really be addressed through really thinking about the health in buildings and healthy building.

We have four visions for every building in Atlanta, and within our office is energy planning, building performance planning, that ties into visions 2, 3 and 4. Next slide, please. Really, the hallmark program that we are looking at as we approach this and has really helped crystallize our work on this issue, is the Atlanta Better Buildings Challenge program. This is a program that was launched in 2011, and we're one of the first three cities to participate in this DOE initiative, and in the Atlanta program we focused on a 25 percent reduction of energy and water use by 2020, using a 2001 baseline.

We have over 160 million square feet of commercial building space committed to the program, which accounts for about 200 properties. Our participants are really varied; we have commercial real estate space, your typical Class A office space, but we also have pretty much every major university in the city. We've established in the last two years a really successful partnership with the Center for Disease Control, which is based right here in Atlanta.

And part of that partnership includes regular health education events; looking at the Fitwel program, looking at healthy models in buildings, things like lactation rooms, we did an education session on; and really, just thinking about your tenants in your building. Next slide, please. Beyond looking at the tenant space in buildings, we're also looking at the impact of the building efficiency outside of the building.

So this slide is a map basically demonstrating the public health, as I said, of the Atlanta Better Buildings Challenge program. Every county that is a color other than gray is a county that is benefitted from the reductions in energy in our buildings. This is the result if you use less energy in a building, then your utility doesn't need to burn as many fossil fuels to power your building, and that has a spillover effect that goes well outside of our jurisdiction.

In fact, the darkest red dot that you see on that map is Birmingham, Alabama, which is in an entirely different state. They are actually the primary beneficiary of the public health benefits of the Atlanta Better Buildings Challenge, and I think they might owe us a thank

you for that one day. Next slide, please. We're also looking at well-being in our own assets. The City of Atlanta has a really broad building portfolio; City Hall, which you see on the right, to our water treatment plants, to the world's largest airport, Hartsfield-Jackson International Airport.

We are doing a lot of interesting things in these buildings. We're undergoing a major energy savings performance contract that through doing these large-scale improvements has really forced us to work out our buildings holistically, rather than through piecemeal efficiency improvements like one lighting project one month, followed by some other retrofit a few months later. By doing whole-building projects, we're able to make sure that we're doing them in a healthy way, so that we're not just sealing up windows without thinking about the impact on our indoor air quality.

And instead when we're sealing those windows, we are also making sure that we make the appropriate ventilation adjustments to make our buildings stay healthy. We have also **just as truth in programming**, we have a wellness center directly across the street from City Hall that employees can take advantage of. We – our city council has passed what we call our sustainable design standards for our own properties, which set in place the requirements that all our buildings can be silver certified for new construction and major renovation, as well as the existing building certification for all existing properties over 25,000 square feet.

These are requirements we're phasing in now. We're actually having to go back to city council in the next two months to revisit that policy, because we got pushback from departments about how there might be alternative certifications that are more aggressive, such as WELL or EarthCraft or others that they didn't want to have prohibited to help satisfy this requirement, because some departments wanna go above and beyond that initial LEED requirement to really look at building better buildings. Next slide, please. And I guess that's it for me. Thank you.

Cindy Zhu:

All right, thank you, Megan. So I'd like to point out some specific resources that were provided by each of our presenters today, which you can access when we get the presentation uploaded online. We have resources from Three Cubed about their research publications on health benefits for single-family; as Beth mentioned earlier, the multifamily results won't be completed until next year, but you can take a look at some of the methodology and findings they have for single-family.

She also sent several other resources around how to make multifamily housing more energy efficient. Sara sent us over a really cool link to a TED Talk that she gave recently on buildings and health, so I believe it's about 15 minutes, so I think that's a great way to learn a little bit more about how Kilroy is tackling this issue. And then you can also learn more about what the City of Atlanta is doing around energy efficiency resilience and health as a whole. All right, next slide.

So let's go ahead and take some questions from the audience. You can continue putting those into the chat box. I will start with Beth, so someone asked if there's any sense on how long the impacts around health and wellness in pre and post weatherized buildings will last.

Beth Hawkins: Oh, I'm sorry; I was on mute. Yes, when we monetize the NEIs, we estimate the annual impact by household, and we base the length of that impact that can be experienced by a resident off the lifetime of the measure, which for this project we were estimating would be 20 years.

Cindy Zhu: Okay, great. We have a couple questions for Sara, so first, there are studies that point to the financial return of health and wellness that tend to focus on value to the tenants and to the employer. Do you know of any studies that show financial value to owners for investing in health and wellness across owned assets? Basically, studies that show the direct benefit to the owner that would implement these measures.

Sara Neff: Yeah. It's really tough for that, because so much of it is very people-focused. So there's a couple of ways to sort of connect that. I think the Stök study I had up earlier, the financial case for high performance buildings, has a lot in there. But beyond that, I know Fitwel is working on _____ there, but I don't know of a direct study that links owner benefit, and this is hard. And I think this is one of the issues of real estate in general is that people don't realize that a different person owns the building from who works in the building.

The concept is a difficult one for people to grasp. So for us, at least in my portfolio, a lot of the health stuff was just really not that difficult or expensive, and we think of it – the way we got sorted out on it was a risk management perspective. So we'd had tenants, for example, who said, "Oh yeah, I'm having a bunch of migraines, and my doctor told me, 'Maybe it's something about your building.'" We're able to send them like a 300-page air quality

study thing, like, "I don't think it's our building," and then often the complaint goes away.

I mean, that's intensely valuable for something that doesn't cost all that much. So _____ engage in _____ early on is a good way to figure out what the ROI is in terms of preventative health, but it's not an easy question. Next.

Cindy Zhu:

Okay, thanks. So this is another question for Sara, but I think Beth might have some insight here, too. So the question is, are there lower cost air filters recommended by the presenter? Our city is at the intersection of major highways, has extensive air quality issues and a very high asthma rate. Although we're now working on energy efficiency policy for rentals, we also need interim practical and actionable recommendations for renters. So, are there any specific type of low-cost air filters that could help this building operator?

Sara Neff:

Yeah. They're often quite expensive. I mean, the one that my kids' school uses – and it's a public school, so they must've gotten the funding for it somehow – it's walkable, so it's near the same freeway that I'm next to. I know those go about 500 bucks a pop, which I can't imagine falls into the realm of affordable. Any HEPA air filter is really what you're looking for. We don't have much of a residential portfolio, so we have the pricier air filters on the floors of my residential tower.

I think there's also – I mean they can clean more than 1,750 square feet, so instead of maybe needing one in every unit, maybe there's some ability to share. But I think it'd be a good idea to start researching just what low cost HEPA air filters there are on the market. They might not be as effective, but they could work. And then the cheaper options are if there's a shared ventilation system, just to plug in a filter in the unit, adding a filter directly to the ventilation system, so that benefits everybody.

There is going to be a trade-off with energy efficiency; this is a rough thing in the world of health and energy. There's a lot of synergy, but there's not always synergy, so if you have a stronger filter, the energy bill is gonna go up. Health _____ and not necessarily cheaper, so hopefully there's a shared system that people can take advantage of.

Cindy Zhu:

Great, thanks. Beth, do you have anything to add about low cost air filtration methods?

Beth Hawkins:

No; no, I don't. I think that was a good answer from Sara, so.

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- Cindy Zhu:* Great. Okay, so let's _____ to this. We have a question about if ventilation was added as part of the weatherization strategies for the Three Cubed studies.
- Beth Hawkins:* Yeah. We found that for the buildings that are participating in this study, 30 percent did not have any mechanical ventilation at all pre-weatherization, and a third of those that did have ventilation only had bathroom fans. I'm just gonna share that pre-weatherization data with you first. But through weatherization, we are seeing that mechanical ventilation is being installed, and for this particular sample, 38 percent of the time.
- Which is actually a little bit more than single-family; single-family, about 26 percent of the time, ventilation's installed.
- Cindy Zhu:* Okay. This next question is for Megan. It says, "Working with universities in Atlanta, is utility data tracking a challenge? I know that many colleges and universities struggle with benchmarking because they lack building-level energy meters."
- Megan O'Neil:* Yes. We are definitely not unique as a city with this level of difficulty, but I'd say any – well, colleges and universities as well as any owner of a large campus-like property, including the city. As an asset manager running into this issue, we have to work directly with the colleges and universities' facilities staffs to identify the best way possible to benchmark, be that as a campus, be it going to the lowest common denominator. We'll have situations where we'll have four buildings that each have their own electric meter, but they're all on the same water meter; and how do you treat that situation?
- And we are so fortunate to have Southface as the program administrator for our Challenge program. They are fantastic experts in this space; really, they can work directly with the managers to benchmark to the best degree possible, so you realize the best possible benefit.
- Cindy Zhu:* Great. And then, how did Atlanta determine the distribution of health benefits associated with Better Buildings participation?
- Megan O'Neil:* Well, on the map that you saw earlier, each county that was highlighted was – essentially, if your county realized \$10.00 or more worth of public health benefits, then it was highlighted, and they got darker as the dollar value increased. That was calculated by a consultancy called The Greenlink Group that did an analysis looking at the grid level impact of efficiency programs in Atlanta, and their distribution across the country.

Cindy Zhu: Okay, thank you. This is a question back to Sara. Have you been able to make a meaningful connection between energy efficiency and health or wellness or productivity?

Sara Neff: Yeah, I can answer that question. It has tended to be in my portfolio that the most energy efficient buildings are the ones that do the best on when we do the air quality testing. But a lot of that is because they are the newest buildings, so we're developers as well as owners, and we develop. We've developed very high air standards, and so – and very, very high energy efficiency standards, so they do great. I think age is a major factor when you're trying to deal with energy efficiency and health.

And depending on the vintage of the building and if there's a lot of where everything was just sealing up the building super-duper tight, then that was great for energy efficiency, but it's a major problem from a health and wellness sick building syndrome kind of thing. These days, with economizers technology improving and whatnot, the trade-ups are not quite so bad; it's never perfect, but so I'd say on a relative basis, my most energy efficient buildings I think are my healthiest buildings.

But also I think that's a little bit of a red herring, 'cause I think that's an assumption of age, for the most part.

Cindy Zhu: Okay. And then someone asked about living green walls, so sort of walls that have plants integrated into them, and whether they contribute at all to indoor air quality. I think, Sara, that might be a question for you.

Sara Neff: Yeah, I can answer that. So the answer is this – and we have a moss wall, though I think there's moss, there's some gray area whether they're even alive. But they – so there are plants that filter the air. So at my desk, for example – I'm looking at it right now – I have a lady palm, and there's – if you listen to the TED Talk, I mention a couple others. One is called a "Janet Craig," which I think is, I don't know, Jennie Craig's botanical sister or something.

And so I think that the important thing is to choose plant types based on what they filter out and what you're concerned about. Recently, the National Association of Realtors, of all organizations, has published a little booklet on that, so to pair plants with what they help take out of the air. I'm a big believer in plants in terms of improving air quality, but I think it's important to choose wisely when you're picking your plant types.

People often pick plant types for esthetic reasons, and that's obviously very important, but actually what they're going to do is something to think about as well.

Cindy Zhu: Great. And then a question for Beth is whether Three Cubed will be looking at studying non-energy impacts of weatherizing market rate multifamily properties.

Beth Hawkins: Oh. Yeah. Well, we're not at this time and haven't yet, not for lack of interest, but up to this point, we just haven't had any funding to look into that sector.

Cindy Zhu: Hopefully sometime in the future, that'll change. All right, so I think that's all we have time for today. If you have additional questions directly to our speakers, we will post their contact information. Let's move on to the next slide. We hope that you all plan to attend the next Better Buildings webinar on Tuesday, April 2, from 3:00 to 4:00 PM, titled Rethinking Traditional Finance: How Energy-As-A-Service Unlocks New Potential for Businesses.

On this webinar, we will highlight a new efficiency-as-a-service toolkit and Better Buildings Financial Allies will share insights from the field. Next slide. Oh, sorry; can you go back one more, to the – yeah, there we go. So additionally, we hope you will join us for the remainder of the Better Buildings Webinar series, where we will be taking on the most pressing topics facing energy professionals with new experts leading the conversations on proven best practices, cost effective strategies, and innovative new ways to approach sustainability and energy performance. Next slide, please.

Registration is now open for the Better Buildings Better Plants Summit, which will be held July 10 and 11 in Arlington, Virginia, which is in the D.C. metro area. Pre-conference activities, such as building tours, will take place on Tuesday, July 9. To find out more information about the agenda, visit the Better Buildings Solution Center link in the slide. We hope to see you there, and next slide. With that, I'd like to thank our panelists very much for taking the time to be with us today.

Feel free to contact our presenters directly with additional questions, or if we weren't able to get to your question during the Q&A period. If you'd like to learn more about the Better Buildings Challenge or Alliance, feel free to check out our website or contact myself or my colleague, Kendall Sanderson, directly, at the email shown. I encourage you to follow the Better Buildings Initiative on Twitter for all the latest, and you will receive an email notice when

the archive of this session is available on line. Thank you,
everyone.

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