

*Sarah Zaleski:*

All right. Hello, everyone and welcome to the 2021 Better Buildings, Better Plant Summit. Wanna thank you for joining us today. We are gonna have a really wonderful session prepared and some fantastic speakers. We're hoping to make this somewhat interactive. So hopefully we'll have some participation from all the attendees as well. Before we dive in, there's a few housekeeping points I'd like to cover. Please note that today's session will be recording in archives on the Better Building Solutions Center. We will follow-up when today's recordings and slides are made available.

Next attendees, we ask – each of you do have the option to share your video as well as unmute yourself in this format. That said, we are gonna ask you that you keep yourself muted when not speaking to avoid any background noise, as I know we have a large number of folks joining us today. If you do experience any audio or visual issues at any time throughout today's session, please send a message to tech support in your chat window located at the bottom of the Zoom panel and we'll do our best to help you as quickly as possible.

All right. So we'll look at the agenda really quickly. So thank you again for joining us today. We're gonna kick the session off with some introductions. We'll have a brief presentation and then we're gonna hand things off to three esteemed guest speakers that represent the architecture, engineering, and construction trades and spaces. Throughout this session we hope to hear from you via the slide of interactive platform. We'll wrap up at the end of the session with plenty of time for questions.

So a few things that we hope you can take away from today's session. So first, we hope that you can learn how architects, engineers, and contractors can really be your partners in delivering owners Better Buildings. We hope that you can hear from leading A architecture, engineering, and construction firms on strategies of how to achieve zero in your buildings and lastly, gain tips on finding, hiring, and collaborating with the right firms. One quick note here I wanna mention, you'll see us refer to zero buildings throughout today's presentation. We generally mean this to mean buildings that are ultra high performing from an energy efficiency standpoint.

Often with site EUI's in the 20's or even lower depending on the building type. We see this level efficiency as putting buildings in the sweet spot to achieve zero energy or zero carbon goals if and when paired with appropriate renewables. So if you can use – so

that's how we'll be using the term zero buildings as these ultrahigh performance buildings. We know that there's an increasing number of organizations and governments that are setting either zero carbon or low carbon goals and we hope this session can really provide some takeaway and practical applications on how you can make tangible advances in those goals today.

So I'm your moderator. My name is Sarah Zaleski. I'm a senior advisor at DOE's building technologies office. I've been here for a bit over a decade and currently I lead our commercial buildings zero energy work, our work our design community and also a number of other initiatives at the building and district and city scale. So I'm also pleased to be joined today by Paul Torcellini and Sammy Houssainy from the National Renewable Energy Laboratory and they are really my co-conspirators in this effort. They're gonna tell you a little bit more about what we're doing to engage, the A, E, and C communities and how that – what that means for some of your work on how to improve your buildings.

Later today we're gonna be here from three other experts that we collaborate in this effort with and we'll introduce them in a few slides. So thanks again for being with us today. A quick note on social media. We hope you'll join the conversation on social media. So here's the information on how to do that. I'll leave this up for just a second so everyone can take a look. All right. So for folks that have been in other sessions with us in years past or earlier this week, we're excited to announce that we're also using Slido today.

This is an interactive platform for questions and answers, polling, which we'll use quite a bit throughout today's session, and also to provide session feedback. So folks, please take a minute to use either another web browser or your mobile device to go to Slido.com. When you get there you'll open a new – when you get there you'll see a place for an event code. Our event code is DOE and once you enter this event code you'll be able to select today's session that we're in right now, which again is The Role of Architects, Engineers, and Contractors in Zero-Carbon Buildings.

So you can use this platform to ask our panelist questions. You can submit them in Slido any time throughout the presentation and we'll be collecting and triaging those to address later on in the presentation. We're also gonna use this to ask you all some things about where you're from, what you do, what some of your goals are and how you go about collaborating with your contractors and design firms as well. So I'll give everyone a minute just to bring

that up. All right. So with that, I think we are actually going to give Slido a whirl with our first poll. Thank you for showing. That's a little bit what it looks like in the Slido app.

I think we're gonna – if we can go ahead and move to the next slide we're gonna ask our first question. We're really curious on where you all are joining us from today geographically speaking. So we'd love to see if it's a city or state where you're hailing from, please let us know in the Slido app and we'll be able to see who got up the earliest this morning for this session. See a lot of Washington DC, Connecticut, Massachusetts, and North Carolina, Waterloo, Canada, California. All right. Ohio. So a really good representation it looks like across the map and across the time zones. Thanks everyone for taking a minute to share that with us.

The next question that we are gonna ask you, we'll ask that you would respond in Slido, is what best describes your role. So we know that the Better Buildings Summit attracts lots of building owners, folks that work for building owners as well as contractors, service providers, equipment manufacturers, program administrators. So we're curious of the mix of folks that are on today's call. A lot of researchers. It feels like I'm watching the Kentucky Derby again. A lot of other. Okay. So it's great to see that there are a lot of designers on the call today. Thank you guys all for joining us. All right. Thanks for that.

So we will move back to our PowerPoint slides. We'll be using the Slido for some more in the weeds questions in a bit that gets into some of the content that we're discussing. So as you know, the title of this session is about the role of architects, engineers, and contractors to deliver zero carbon buildings. I know that's a thing that I – zero carbon buildings are something that I think a lot about. I think increasingly more of us do. So traditionally Better Buildings has really been a partnership program, I would say, for the most part with building owners and folks that represented building owners.

We've had a financial allies piece of that and well as some other subprograms as part of that, but we really recognized how important the role of these folks were in delivering the buildings that we want to and really need to build. So this goes for both new construction and retrofits I would say, but the decisions and the skill sets of these folks in the AEC community, I'll say, really impacts building energy use obviously, the carbon admissions, operating costs and the comfort. We know that this community can

play a key role in really enabling and helping building owners achieve their energy and climate goals.

So this really critical stakeholder group to enabling these better buildings we saw is a really wonderful time to engage them and really think as a community how we can scale those promising solutions more broadly. So that caused us to launch a new initiative last year called the Design and Construction Allies Program, which we launched last year. And Paul and Sammy from NREL helped me lead this effort and I'm gonna turn the slides over to them to tell you a little bit more about this effort and what we've done so far.

*Paul Torcellini:* Can you hear me now?

*Stet Stanborn:* Yep. We can hear you, Paul.

*Paul Torcellini:* Okay. Great. Thanks. I was struggling with my mute button there and I'm sure others have done the same in the past. Well, thanks, Sarah. Want to just thank everybody for joining today and as Sarah mentioned, we started looking a lot of Better Buildings works with owners and operator of buildings. They're the ones that pay the energy bills, that are responsible for that. They're trying to meet greenhouse gas emissions, targets. But as we dug into this, a lot of it had to do with design decisions that are being made, that those people that own buildings and hire design professionals, hire contractors to actually implement what they wanna do.

So we launched this effort last fall with a smaller cohort and one of the things is if you're interested, we'd love to talk to you more about this program. This is a screen shot of our website. So going to the next slide. So for a programmatic goal point of view, one of the things that I like to think about here and often questions that I ask is what is stopping us from getting to zero ready buildings today. Again, as Sarah mentioned that could be energy and/or carbon or just having a substantial impact in how much energy a building uses. What's stopping us today? That really then starts to identify what the barriers are to do that.

So this group has started looking at barriers and trying to address those barriers so we can deliver more zero ready buildings. It's really about making this routine. There are lots of zero buildings out there today in one form another, but lots is somewhat relative to the whole building sector. So really thinking about what it takes to make this routine so that it happens every day. Really the goal would be with every building. So next slide. So Sammy?

*Sammy Houssainy:* Yeah. Thanks, Paul. So as part of the design and construction allies efforts we now have 11 firms that have signed an agreement to date since the launch of the program. We do have other firms, about 13 other firms that are really actively involved as well and they're engaged and we know they're working internally to get the agreement signed as well. At this stage we are looking for more participants. So if you're interested in joining please visit the program site. We have it displayed here on the slide on the right for more details on how to do that. In the next few slides we'll also discuss the level of involvement that is expected from the allies. So stay tuned for more information on that.

Next slide. So this here is just a visual of the major stages of the program just to give you a sense of our approach. So you can see the first three stages have checkmarks above them because they're essentially completed. The first stage was really centered around working with the allies to set goals for designing and delivering zero ready buildings and putting together metrics of success that are quantifiable and measurable against those goals. The next completed stage was identifying the barriers that come in the way of routinely designing and delivering zero ready buildings, which I'll actually talk about in a little more detail in the next slide.

We then formed two working groups around the barriers to really take a deep, deep dive and really identify the resource gaps and developing missing solutions that are needed to address those barriers. We're expecting the allies to then implement the solution and provide feedback on what went right and what went wrong and help with disseminating and scaling the solutions for a broader adoption and impact. So next slide. So one of the first things we did as part of designing construction allies is we asked the allies to identify and rank order barriers on a relative scale to delivering zero ready buildings and this here is a result of that exercise.

What we found is that the results are consistent with larger studies that are conducted in the literature. It's important to note that some of the barriers are intertwined, but it was interesting for us to find out that the design and delivery community does seem to struggle with higher perceived costs. You can see that bubbling up at the very top there. They also struggle with lower demand from their customers. Another interesting point here is they've also ran technology limitations as the lowest on this relative scale.

Next slide. So working groups. So at this stage of the program we have formed two working groups around barriers that were prevalent, that we can make substantial impact of address and that

can be addressed by the group. So these two working groups are shown on the right. The first one is centered around cultivating client demand, which really encompasses a few of the top rank barriers from the previously slide. The next working group is centered around developing solutions to address embodied carbon considerations in the design and delivery process. Next slide. Paul, maybe you can let us know how to get involved in the allies.

*Paul Torcellini:*

Sure. So we currently have a group call once a month, sometimes it's every other month, and we're really focused in working out solutions. So one of my challenges I bring to the group is we have barriers. In fact, we've spent a lot of time identifying lots and lots and lots of different issues and barriers. Really we're trying to shift now and our panel will talk about this in a minute, but how to shift that into how do we solve some of these things and what can collectively we do to get through some of these barriers. Again, like I said earlier, make this routine.

So it's participating in those working groups. Those working groups are meeting about once a month. Like a lot of good programs, the more time you put into it, we hope the more that you get out of it. So that's really what's involved for the allies. It is limited to design firms and contractor firms. So I know there's a lot of owners on the line too. As this builds out I would encourage you to go to the website and use this as a resource for owners because ultimately we need everybody involved and all these decisions made in order to really achieve a difference in how buildings are designed and delivered.

The owners a really important part of this in working with these allies to validate the solutions and show that they're really working, showing through case studies and measured data that we can get the performance that we wanna have. Then another important part for owners is really let us know – we'll provide contact information at the end – what some of your needs are, what you see some of the challenges here that we can bring back to this group. So look forward to others getting involved in this effort. So next slide.

*Sarah Zaleski:*

Thank you, Paul. Thank you, Sammy. So we're gonna go back to Slido here for a minute and we have a question for folks. So for folks that are on the line that do have buildings or are influencers to the decisions building owners make, how likely are you to build a zero, zero ready building in the next five years? There's four choices here, maybe, definitely, not likely, or highly likely. I didn't really say those in order as we're watching these results come in. And I should probably add too, build or retrofit a zero building

because certainly a lot of this is very relevant for retrofits as well as new construction. All right.

*Paul Torcellini:* And again as we go through these –

*Sarah Zaleski:* Go ahead, Paul, please.

*Paul Torcellini:* Yeah. Just as we go through these, these are fascinating results. Especially thinking about, and maybe I will challenge the not likely, what are the challenges out there in doing this? Bring some of those tough questions to the panel a little bit later in the presentation.

*Sarah Zaleski:* Great. So it's interesting to see that over a quarter of you are saying definitely. So there is lots of work to be done and hopefully we can learn about some of the strategies that the folks on the line have used to deliver some of those buildings in the recent past. All right. So we'll go to the next Slido question. Thank you for those that are participating. As an owner or a decision maker, how confident are you about finding the right design and contractor teams to provide zero buildings? So if you did have this goal do you feel like you could find the right talent to help you design and build these high performance buildings?

Okay. So it looks like the leader was the one smack-dab in the middle, the somewhat, from like a certainty to not at all. Looks like most folks are in the middle. Okay. So we will help to give you some tools so that I you can find the right talented skillset to help you get the buildings that you're hoping to add to your portfolio. Thank you. Then we have one other question before I turn it over to the panelists. The last question is – and this is gonna be more of a word cloud, so blank answers to put in. What do you, as an owner, look for when hiring designers and contractors for your projects?

Interesting. So I'm seeing experience looks like the runaway winner. We also have passionate for climate action or passion for climate action, innovation, creativity, low bid, longevity, quality, knowledge, experience with a particular type of project. So it seems like there's a lot about around experience, knowledge, qualifications, obviously some other responses here too. So I think we'll tease that maybe a little bit later like how would you gauge experience, what are the markers that you would look for in metrics to really try to get a handle on that. So thank you. Thank you, everyone, for sharing your thoughts with us on this. I find this really interesting.

So I appreciate your involvement. So like I said, if you're having any issues please let me know, panelists or attendees with the tech function. But at this point we're really gonna turn it over to three really wonderful professionals that I feel grateful to have the chance to work with through this effort. Ryan Jang of Leddy Maytum Stacy Architects is representing some of the leading architects and what – he's gonna tell us a little bit about from an architect's perspective how they can add value and some of the strategies they've used to achieve these high performance buildings.

Then we'll hear from Stet Stanborn with the SmithGroup from an engineer perspective around is some of the same areas. Then Ryan Poole from DPR Construction about the role of your builders and how they – in construction firms and how they can really help bring the project across the finish line to deliver you some high performance results. So with that, I will turn it over to Ryan Jang.

*Ryan Jang:*

Good morning, everybody. Hopefully you all can hear me. I just wanted to say thank you, first of all, to the Department of Energy for including us and all the speakers. This is a really exciting opportunity to speak with you here today. I had a principal with Leddy Maytum Stacy Architects. Good morning from the west coast. It's a little bit earlier here than it is for some of you over on the east coast. We're a medium sized architecture firm in San Francisco. There are about 40 of us.

Next slide. And we are architects. We focus on what we call mission driven work and just this generally means that our clients have a specific disposition or agenda as an organization and the buildings that we create for them really are geared to support that disposition and serve that agenda. In terms of typology, for us that means working on a lot of housing that's mainly affordable and supportive. A lot of our clients here are nonprofit developers and some of the different types of housing includes housing for special groups like veterans with a formerly homeless transitional housing or even those with special needs.

Education projects for us include K-12 schools as well as a higher education project. And the one challenge here is really designing a building and its performance to complement the pedagogical and academic goals at a given institution. Finally, our community projects, we work with nonprofits or local municipalities, things like community centers and libraries. Many of these projects are adaptive reuse, which repurpose existing buildings. So none of

these two projects are the same, but one common thread that we bring to each project and that any architecture bring to a given project is really a high regard for both social and environmental responsibility.

We've been doing this for a while, but increasingly we're trying to look for interesting ways that these two things are interdependent upon each other. So next, we – Paul and Sarah asked us to focus a little bit on how owners, first question here, can enable architects to do their best work. And there's just three simple things here on this slide. The first is the 20/30 commitment. The 20/30 commitment by the American Institute of Architects is a group of almost 900 firms that are signatories to this. These firms are committed to zero energy buildings by 2030. And there increasingly aggressive metrics year over year, five years over five years towards this goal. So we get there gradually.

For building owners, firms that join the commitment state that they explicitly value sustainability in building performance and it's a simple way to demonstrate alignment if you, as a building owner, have those same goals. The metrics are standardized and we can compare our projects to each other. We can compare against building – across building typologies and differentiate between different climatic or geographical locations. And it always happens, but sometimes we track all our projects and not all of them meet the standards for the given year.

So it helps us focus resources and efforts on where we might understand what we can do more to think more creatively about typologies that might be more difficult than others. Taller multifamily buildings, for example, are a little bit more difficult. The second thing here is about a climate action plan. We know that every company, every building owner has a mission, has core values, has a distinct culture. So we would ask the question and you might ask your architect how might environmental sustainability complement or amplify your company's overall goals whether it's with regard to recruitment and in retention of employees, saving on building operating costs, creating healthy indoor environments, prioritizing wellness, even stakeholder expectations.

So beyond being energy efficient and meeting the needs of these occupants, we really look in our buildings to tell a story about those who inhabit the buildings and the organizations that they serve. The image here in the middle is Jacob's Hall at UC Berkeley. It's an engineering building that has all sorts of cool stuff

in it. It has laser cutters and 3D printers and everything else. This building is really always in a high state of energy both literally and figuratively. It's distinctive architectural features, it's PV array forming a large overhang on its sloped roof. So when we conceived this idea we knew that this building would be used by engineering students to tackle society's biggest challenges.

We thought it would be an aspirational statement to allow the creativity of the users inside the building to literally be powered by the sun's renewable energy and expressed by this roof array. And finally, expressing – ask your architects how to prioritize risk and resilience future proofing. Buildings last for a long time. We want them to adapt and perform well over time. Beyond, again, reducing operating costs, we work with our clients often to identify possible hazards that a building or that users might face through the life of the building ranging from climate change, earthquakes, extreme weather, even pandemics.

So how might the buildings respond to these hazards and what specific design strategies might we build in from the beginning to mitigate them? Sometimes this influences the structural systems of the building and it's esthetic such as the community center in Oakland shown in the image on the right. It'll be made of mass timber as a carbon reduction strategy and it's engineered to be more resistant to resist size and the capacity than what code requires. The neighborhood can come here during an event such as seasonal fires or a power outage and be safe and have a place of refuge.

Next slide. Finally, we can get into this more I think during the discussion time, but just a few strategies to get to zero. The first one of course is low and body carbon. We discussed this a little bit in the previous slide, but embodied carbon is becoming a more significant priority beyond energy efficiency and understanding structural systems and how they might meet the building's needs and how they might also help to get to a lower carbon alternative than from one structural system to another.

Electrification and passive survivability, more and more municipalities, at least in California, are going all electric, looking to omit natural gas and other fossil fuels as a source of energy. The grid is becoming increasingly greener and more renewable. Of course a related question is how a building can keep the shelter inhabitants for an extended amount of time after a power loss. This might mean back-up generators still relying on fossil fuels for a while. Our university clients like to go this route. Other buildings,

smaller buildings, might be able to utilize battery back-up to onsite photovoltaic arrays.

Beyond zero in housing equity. No matter what type of building you operate, even if it's not housing building, we know that social environmental equity are inextricably linked and we know that climate change disproportionately affects those who are economically disadvantaged. So for our communities to really thrive and for all types of buildings and businesses to thrive I think it's incumbent upon all of us to really prioritize housing equity and a place to live as a basic need for everyone in our communities.

Finally, ask your architects how they are activists in their own communities, what issues do they advocate for, how do they care about them whether it's sustainability or something else. This is something we talk about a lot with our staff. And how a project or an architect might think beyond the property lines of that project and how we as citizens might help bring about a more green and equitable future for everyone. So that's it for now. I'm happy to talk more when we get into the discussion session. I'll hand it over I think to Stet at SmithGroup now.

*Stet Stanborn:*

Thanks, Ryan. So hi, everybody. My name is Stet Stanborn. Like Ryan, I am actually also located in San Francisco and I'm a principal for SmithGroup. I lead our engineering team for northern California. We can go to the next slide. I've been working on all electric and net zero energy buildings for pretty much the last 17 years or so. And that's partially why I actually joined SmithGroup a number of years ago because of a joint passion around sustainability and also aggressive research and development along trying to move net zero energy buildings.

So our firm in particular has joined the allies group, has been quite active in large part because of the climate crisis that we're in. Also in large part because we like to help our clients do risk assessments and build the highest value that we can into the projects that we build for them. And for owners, especially owners that plan to hold their assets for a long period of time, we wanna make sure, as Ryan was talking about earlier, that those assets are resilient to change.

So that we do the right thing on day one and we can reduce how much we work as required later on or sort of change out of systems over time in response to both increasing temperatures, or in the case of projects on the west coast, increasing risk around wildfires, smoke resilience, and indoor air quality. So all these elements

around climate smart design are actually all interdependent. So there's both an interdependency of energy, water, air quality relative to climate change. Also layered in on that is a time value of carbon and this is a concept, if you've heard Larry Strain at Siegel & Strain Architects talk about the carbon that we're emitting right now through our construction efforts, when it's embodied carbon for our construction or existing buildings and their operational carbon, the carbon that is happening right now is exceptionally important and far more important than necessarily the carbon that we're going to emit in 60 or 70 years.

So we have a huge focus at our firm right now on doing two things at once, dramatically reducing our embodied carbon through construction. The image here is actually a project that we've partnered with DPR in their Sacramento office using properly sourced low and body carbon CLT construction, but also a net positive energy retrofit. So existing buildings doing modifications to them with low embodied carbon materials and then layering on top of that going beyond net zero. So all electric net positive energy design with battery back-up.

So we're trying to focus our attention on this because we see that as two fold. One, addressing climate crisis right now, but also helping our clients again, and building owners, put as much value into the assets that they plan to hold. Next slide. So one of the quick questions that we were sort of thrown at is how can owners enable AAC firms to do their best work? SmithGroup is an integrated AE firm. So we have architecture, engineering, landscape architecture, so the whole gamut, interior design. And we get asked this question a lot, "What would we like to see in an owner for these projects that we're doing that are all electric or net zero energy, net zero carbon?"

The first thing I would say is when you're issuing your RFP's, include that requirement in the RFP. Instead of saying we'd like to study this and we think it might be a potential goal or a stretch goal, I would just emphatically say this is the project requirement and by doing so you're – it addresses Sarah's earlier question that was in the Slido about your confidence level and your ability to attract the right team. If that requirement is in the RFP, first off you're going to start to attract the attention of like-minded folks that are interested and definitely bring that experience level. It provides that baseline for you to actually start to measure that experience.

So all the teams that are coming forward are bringing their best game around net zero energy, low carbon design, et cetera. So just putting that as a project requirement I think is going to elevate the conversation and during the selection process for finding the right team and the right cultural fit for your project, at least then everybody is bringing to the table that base level experience of being able to deliver net zero energy buildings.

The next piece, which often isn't discussed, and it's really around transparency within your pro forma. So often times in sort of traditional building delivery, the owner, the deliverable sides have an opaque wall around their finances and how the project is actually going to be procured and what financial mechanisms are needed to deliver that. I would say when we're starting to focus on net zero energy and low carbon buildings, one of the best things that you can do is actually bringing your design team into the fold and discussing some of the limitations or struggles or challenges in how you're providing the financial mechanisms to deliver that project.

I say that because especially on the energy side there's a number of ways to actually deliver the renewable energy systems, for instance, to pair with your project and that can pair specifically with how you plan to finance your project. Having us in the fold to discuss those strategies rather than having us size a system or size equipment and then just throw it at you and then you have to figure out everything on the backend, bring us into the fold because there are ways that we can bring to bear for the project that actually can make the financing side easier or it can make your Proforma more beneficial and that can be anything from helping you identify components that can take advantage of accelerated depreciation, looking at modified PPA programs or power purchase agreements so that you don't have to put up that capital on day one for your energy component of your system to a whole host of other incentive programs that we know about because we're connected in a really robust way with local utilities.

So I would say transparency works – and this is especially true on our project that we do as either design build or progressive design build. That cost transparency between the contractor, the engineer, the architect, and the owner can actually deliver you a much better project at a lower cost and faster. So there's a lot of benefits on opening up the books on both ends so that everybody can understand how you deliver the project. The last item for this slide, we're often asked to just provide analytics. How can we get to net

zero energy? What's our EOI? Are we gonna get – can we offset on site or do we need to offset our energy elsewhere?

I would say beyond just those fundamental questions around low energy buildings, there's a whole host of analytics that we can bring to a project that can align with your values or your tenant values or your staff values depending on the type of project that we're building. So one of the things that we get most excited about on the design side is when an owner is really engaged in the analytics of whether it's indoor air quality, net zero energy, façade performance, daylighting, all of those components that go into how a building actually operates after it's inhabited.

If the owner has a passion around any of those items or if you carry passion in from the folks that are going to inhabit the building, then from a design standpoint we're gonna be much more successful in delivering you a project that's not only low carbon, but also meets all the other criteria that get people excited about your project and that's what we're trying to do is bring excitement around net zero so it's not just like an add on to the project, but it's integrated into the core of how the project is designed. So in the next slide we're gonna talk – I wanna talk a little bit more about some examples around how that analytics piece and the financial piece can actually help you make decisions as a building owner.

So I'm gonna use the example as Ryan mentioned, resilience. Especially in the west coast right now, but honestly, after the derecho in Iowa this last year, the flooding out east this year, hurricanes. It's not just wildfires in California, although most of my experience is on the west coast. But resilience is incredibly important and as we look at low carbon buildings, low energy buildings, and especially as we look at electrification, resilience is becoming an increasingly important topic.

When I saved – when we talk about the financial mechanisms and why opening those books can help is that the solutions that we bring to the table for low carbon or all electric buildings, the back-up strategies even have different financial structures. And whether it's just purely a back-up element, like a generator that just sits there every day, it sits there doing nothing. It costs a lot of money to sit there and do nothing. Once a month you have to test it, which costs money and has emissions associated with it, but it's not an asset that brings other value.

So one of the things that we like to do on our projects in collaborations with owners is try to find strategies that meet the

resilience goals, while at the same time providing additional value the other portion of the year. So rather than just being a back-up component, can they provide value either in reducing energy costs or demand charges, et cetera throughout the course of the year. So we do a lot of actually full life cycle financial modeling for resilience and particularly for our net zero energy buildings. So this is just an example of comparing the life cycle cost of a base case generator versus a generator plus a PV system. So again, that PV system in an islandable microgrid can provide you daytime energy. While the sun is out you can produce power. So that can actually offset some of your back-up power needs.

Beyond that, it's actually providing a benefit throughout the rest of the year. So again, looking for those larger benefits. And in the case of clients who wanna go completely carbon free or move off of operating carbon, we definitely are doing quite a few islandable microgrids with batteries, PB's, and sometimes also a generator. These three scenarios are looking at both how to reduce carbon emissions throughout the year and do it at the lowest levelized cost of energy that we can.

It depends on which – it's highly dependent on where you are, which portion of the country you're in, what tariffs your utility structure have set up, and what incentive programs are available, whether you're for profit or nonprofit. All of these things come to bare, but that's why the transparency on how you are gonna procure your project is really important because we can help you. We can be your allies in actually delivering new cost-effective solutions that fit within your performing model.

Next. So I just put in just some of our high level – this is our generic road map that we use for almost every project in trying to achieve net zero energy or certainly reduce energy costs. So the first one, even though solar panels are sexy, the cost is falling, they're great, we still start with fundamentals and first principles on reducing energy loads. So that tends to go to focusing on really high performance and closure systems, building envelopes, and reducing our internal loads through appropriate equipment specifications. That even includes on the owner side, owner procured, owner installed equipment. So we do a lot of laboratories and hospitals where the owner is specifying equipment that's gonna be coming in the building.

We do a lot of work to actually work with our owners to find the lowest energy versions of those that meet their project goals, meet the requirements of the project. We can often cut the internal loads

from plug loads even by almost half just by focusing on specifications for that type of equipment. We definitely focus on climate analytics and do a lot of parametric modeling to find the best sweet spot for systems and that envelope and then we have obviously a bias towards low entropy systems, so radiant systems, chill beams, system that we can provide heating and cooling at mild temperatures 'cause we can get the best performance out of those. We're always looking for heat recovery sources whether it's exhaust air from fume hoods off of the lab or whether it's sewage heat exchange like we did at the DC water headquarters.

On-site storage and on-site renewables are now increasingly important for resilience and also grid alignment. So the grid connected efficient buildings or GCEBs is a huge focus of ours in making sure that we're doing buildings that align with the grid and can drive more value, not just for the building owner, but also for the larger utility sector as well. So these are our generic strategies to – that we go through for every project, but we like to establish these goals with you as the owner or with the other design partners on the project. I think that's it for me and I think I'm handing it off to my friend, Ryan, at DPR.

Oh, wait. Sorry. Last slide. Oh my God. I totally forgot. So embodied carbon is incredibly important not just operating carbon. So I wanted to throw out this slide just to advocate for building reuse and advocacy around building retrofits for net zero energy. So this is my choose your own carbon adventure slide. If you're working with an owner I'd say advocate for reuse before new construction. We have millions and millions and millions of square feet of existing buildings that are low performance and if we really wanna make an impact on climate and carbon, then I would be advocating that we should be tackling those projects first instead of just building new net zero energy buildings. Let's build old net zero energy buildings first. So with that, I'll hand it off to Ryan.

*Sarah Zaleski:* Thank you, Stet.

*Ryan Poole:* Yeah. Thanks, so much Stet and Ryan for teeing that up. And I'm glad you got your last message in there, Stet, 'cause it's a great one. I think one thing that you guys are gonna see through all of this is that there's a lot of commonality between what Stet and Ryan are talking about. It's just a difference in perspective. So I'm glad that we're all coming together. Again, Ryan Poole here from DPR Construction and I lead sustainability for us globally. We're a contracting firm that has offices all throughout the States and some in the EU and Asia as well. Technical builder. We do self-perform

some work as well, but really pride ourselves on sustainability and being a sustainability leader in our space.

So I'm excited to talk to you today about some of the things that we're doing in house, one being that we have a group of over a hundred people that we call environmental advocates that have various roles. So all kinds of different roles in our company, but people that are passionate about continuing to push forward as well. Then over 600 accredited professionals within our organization as well. Go to next slide. So I wanna come back and really hone in on this one message that both Ryan and Stet mentioned as well, but collaboration and early collaboration is key to success.

All of our research has continued to point back to this, that an integrated project delivery with an integrated team understanding the goals early, all together, and looking to constructability as we go through design and cost align with that is paramount in being able to achieve the goal of creating a high performing building at market rates. The earlier we can all sit down and plan together, the better aligned we're gonna be throughout the entire project and be able to deliver your goals that you're trying to get towards.

It's often that we're faced with coming at towards the end of the design and then having to be the bad bearer of news to say, "Hey, guys. We've got to sit down and do some value engineering here because we're over cost and we've got some constructability issues." So just want to really focus on the importance of bringing all of your engineering, architecture, and construction firms together at the beginning of your project to create a collaborative team that can work through the entire process together. Focus on strategies that are economic for your specific project.

Here I've got to give a shout out to some of my mentors within our company that are actually Dean Reed and Atul, who are both leaders at DPR, help co-author a book with two Stanford professors that is actually the book on integrating project delivery. So if you haven't read it, it's a great book that goes through and tells you how the system works as you continue to integrate and the benefits from it. Can go to the next slide. So the other thing that I really wanna leverage is at DPR we try to do something a little more unique and try to provide the industry with really great data on how to build high performing buildings. So we took some of our own office spaces. We have six currently and a couple more on the way, which I'm really excited about.

So these are all of our offices here that I've got listed are net zero energy. All of them are also in different climate zones. So they all took different strategies to achieve net zero energy. They all have their own accolades and everything as well that we're really excited about, but one thing that I wanna reiterate that design partners talked about here was driving down your energy use intensity. The first and foremost strategy should not be let's get everything that we want in the building and then just provide renewable energy to make account for it. The best strategy is to continue to drive down your energy use intensity to begin with so that then we have the flexibility to add and grow more as we continue to grow your programming.

It also continues to drive towards the resiliency piece and making sure that your space, no matter what the challenges lie ahead of us with energy in the future, your space could be able to provide that energy on site or at least a significantly reduced energy use intensity so you aren't subject to fluctuations with energy charges within the future. Another thing that I also really wanna play up that Stet mentioned was – and Ryan as well – which is the amount of building stock that we already have available, the most sustaining – sustainable building and high performing building that you can build is one that already exists.

If you really, really wanna look at lowering your embodied carbon, use the materials that are already there. So each one of these offices here are also an adaptive reuse project. Some of them have really interesting stories. They used to be some – our Phoenix office actually used to be an adult video store. Another one used to be – it was an abandoned warehouse. So they were spaces that were at the end of their life from most people's perspective, but turning them into something new and beautiful, lowering the carbon throughout that, is a really exciting thing on the backend.

So though we have to continue to build new because we're gonna continue to grow, I totally agree with Stet and Ryan in that let's look at adaptive reuse on the front end. Let's look at existing buildings and how we can continue to drive those towards zero energy. So I wanted to bring this full circle too with embodied carbon. So the net zero energy side and looking at an operational carbon things, but we've learned over the last decade or so that operational carbon is obviously continues to be a huge piece of it and we're battling that challenge.

One challenge we haven't been battling head on is embodied carbon and it makes up a significant portion of the carbon that we

have within our world. So building materials, main building structures are the most carbon intensive within your building. So there's been a big focus on how do we really drive lower embodied carbon materials within the industry. So trees and wood, for instance, have a unique place in this because it's one of the only renewable resources that we have to build with and it naturally sequesters carbon. So throughout its life cycle, through photosynthesis it will actually sequester carbon.

Then as we harvest that wood and process it it continues – that carbon that's been sequestered in throughout its lifetime can then be stored in the building product. So here you see some really awesome pictures of our new Sacramento office that used certified cross laminated timber and we did some calculations to figure out how much carbon did we actually sequester from utilizing mass timber. So here we actually had 55 metric tons of CO<sub>2</sub>. That equated to about 200 ton per square foot.

So I ran a quick calculation. I said, "Well, hey, what's the building stock that's left to be expected to add into the world?" It's 2.5 trillion square feet between now and 2060. So what will we do if we actually looked at the magnitude of carbon within that? Just say we took the same strategy we did with that at our Sacramento office and what does that look like? So it equates to 116 million tons a year. We got some really great diagrams here at the bottom that show that one DPR office, the amount of carbon that we were able to sequester from choosing low carbon building materials can power 14 homes for a year and is the equivalent of taking 33 cars off of the road.

So that same equation looked at from the global building stock is the equivalence of 29,527,273 houses powered per year and about 69 million cars off the road. So an incredible impact that we get here from those and just want to say that mass timber is not the only solution. We're seeing incredible things happen within concrete, steel, all kinds of other major building materials. Concrete particularly you can see recycled glass pozzolan being used as a replacement for cement.

Actually even now have where we're putting air scrubbers on industrial stacks and turning that carbon emissions into a liquefied form and using it as a binding agent and then there's actually another organization out there near Stet and Ryan in the west coast that's turning it into aggregate. So they're actually taking the liquefied carbon and then turning it back into aggregate so it acts as a cement. So incredible things are continuing to happen to lower

embodied carbon, not only in main building materials either, but also in your furniture finishes and other products that you use within your building.

So there's a continued focus. We've got to continue to leverage the momentum that we have to drive towards zero carbon solutions and operations in embodied carbon as an entire industry. So I'm excited about the future and collaborating with my friends like Stet and Ryan and other design partners and the Department of Energy as we continue to figure out the proper solution so we can provide these at marketable rates so it's economical for everyone to be a part of the solution.

*Sarah Zaleski:*

Thank you so much Ryan and Stet and Ryan. Those were fantastic presentations and I think you gave us some really tangible tools and ways to bring out the best in your skill sets and your teams. So thank you so much for all of those presentations. We are going to turn it back over to a bit more dynamic interactive format for the remainder of the hour – excuse me – or the remainder of the 90 minutes or the next half an hour. We're gonna put up a couple more Slido questions and as folks are taking the time to answer this, I'll ask the first one.

So if you're an owner or work with owners, have you included energy performance specification such as an energy target in your instructions to design team or into procurement documents. And that's I know something that Stet mentioned as a real key strategy. And I think as we're getting those responses, I'm gonna look at some of the questions that were submitted to our panelists through Slido and one of the first ones is, let's see, "High performance buildings are seen as a premium and often more expensive to deliver than traditional buildings." And I think you all alluded to that in one way or the other.

"So how do we convince the market and owners and others in the market that it is possible to deliver high performance buildings on more projects including those of low income housing and light commercial?" And I know Ryan Jang, who started us off, it sounds like your architecture firm has a bit of experience in that space. So I don't know, Ryan, can you kick us off with maybe some thoughts on that question while folks respond to this poll?

*Ryan Jang:*

Sure. And I know that each typology is a little bit different and affordable housing is fairly specific, but one of the unique aspects of the nonprofit developers we work with on this type of housing is that they own and operate the buildings for the life of the building

really. So they're not developing a condo and then selling them off or there's not a ten year type timeframe to the work that they do. Instead it's sort of a 50 year or more time frame while the residents move in and out. So that like cycle cost analysis and the idea that the first costs need to be balanced with the long term cost becomes much more of a priority for this type of owner. I'd imagine it's the same for other types of owners also that hold on to the buildings for a long time.

We end up getting involved in those conversations early on about maintenance and about running the building and about being a systems and everything else like that because these clients really care about that and they are sometimes more willing to invest in the up front costs if we can demonstrate with our construction partners such as Ryan Poole, that the return on investment and that it's worth the while. So that's pretty – it's pretty simple in that regard. The strategies and the technologies I think change over time and are a little bit different from project to project, but the idea that you need to be concerned with the long term maintenance of your building and operating cost is a huge priority.

*Sarah Zaleski:*

I really appreciate the fact that you used, Ryan, the term "future proofing." So not making a huge investment to something that might be obsolete or behind the times in a few years. I thought that was a great point too. Ryan or Stet, did you wanna add anything to this question?

*Ryan Poole:*

I'm sure we both do. Yeah. So I just wanna capitalize Ryan on the aspect technology is evolving. So PV is significantly less expensive now than it was and it's significantly more efficient. It's continuing to grow. One thing I wanna key in on and we all said it is driving down the EUI. We mostly focus on passive elements when we're doing that. Passive elements tend to be less expensive than some of those other ones. They're not gonna fade out with technological advances and they're driving down energy use intensity. So you don't have to pay for it on the backend. So I wanna say –

*Sarah Zaleski:*

Ryan, could you give – sorry. I was just gonna say could you give a couple of examples of those passive elements?

*Ryan Poole:*

Yeah. Sure. I keep going back to some of our offices 'cause I love talking about them. Stet, you're right. I do, but the Phoenix office, for instance, has a chimney stack. So it has a heat chimney up above it because it actually circulates the air because all of the heat rises from it and it uses really large fans at low velocities to help

circulate that air. We have a labyrinth below our Sacramento office that Stet helped design. So it actually circulates air below the space through a series of canals, if you will, to condition this space before the air gets pushed in. There's all kinds of other really efficient systems. Stet, I'll let you weigh in from there.

*Stet Stanborn:*

Yeah. Well, I think one of the things that's really exciting and especially when we're doing collaborative work where the contractor and the design team are on one team and getting to have that back and forth. Our approach is not to add, but to move from a money standpoint. So we're working on a project that's pretty far into construction right now in Davis, California for UC Davis and that project, there was a fixed budget. The budget, it wasn't going up. The client, UC Davis, really wanted a net zero energy ready low EY building, but at that same cost that all their projects are delivered at.

So we worked really hard at another project that we – we work a lot with DPR, but another project with DPR because they were transparent in cost we were able to move money out of the HVAC bucket and put it into the enclosure. So it's actually one of the images that I showed in my deck that I'm pointing to. A true, thermally broken, R25 plus wall assembly in noncombustible construction, all the requirements for commercial scale buildings, but thermally broken really high performance window, high performance blazing, shading devices, all of those things just sit there and they have a very long service life compared to say a heat pump that may fail after say, 15 years, 12, 15 years where you have to replace it.

So again, because the owner said, "Yes, we're gonna own and occupy this building," we went and moved money into the enclosure, but at the same time are doing real time load analysis. So downsize the mechanical distribution system. So instead of just making – just adding on high performance envelope and then keeping everything else the same, we're balancing it real time. So moving money, reducing the complexity and the cost and mechanical system, put it into those things that just sit there and last 50 years.

So it's less of what can I strip out of a project or what can I add to a project and for us it's more about moving money into the high performance elements that have the lowest operating cost or maintenance cost. On that same project, it's a radiant stealing project, classroom building. So that tends to be considered a premium product, but because we got the loads low enough we

only needed about 30 percent coverage of the sealing with radiant panels and then we were able to reduce that further because we added ceiling fans and ceiling fans do a couple of things. We can reduce the duct work 'cause the ceiling fans, if they're connected to the beam mast they actually can help distribute air, very low pressure drop, none.

So we get better output from the ceiling panels because we have more conductive air movement across the ceiling panels. So again, we can downsize the ceiling panels because we can use ceiling fans. We can actually reduce the cooling or let the cooling set point lift a little bit up to 78, 80 degrees because the air movement from the ceiling fans can bounce the thermal comfort aspect. So it's about an integrated design, but it's also that collaboration with our construction team to find where the highest value is. How can we get the highest performance at the lowest cost? It really does require collaboration.

*Ryan Poole:*

In a cool life cycle analysis, right, Stet, to be able to compare those elements. One last thing, Sarah, I wanna mention to particularly this group is don't forget there's a lot of financing options available now too to help support low carbon solution. So particularly lots of changes within the financial sector, big Vanguard, Black Rock, continuing to shift a lot of their portfolio towards ESG investing. So you'll see there are a lot of investors that want to help push facilities towards this resiliency because they want their buildings and then their assets that they're invested in to be resilient. So I don't wanna discount too that work within the project budget, but also know that there are financing options available as well.

*Sarah Zaleski:*

Yeah. Thank you for that. And the federal tax incentive called 179D for different systems was made permanent in December. So that's exciting. So that's one other pathway for funding here too. So thank you, guys. Those were all excellent examples, very tangible. So we're gonna turn it back over to the poll and ask our attendees another question. So what would you, as an owner, if you are an owner or anyone else, like to see from your architecture, engineer, or construction firm to help achieve your goals? So what would you like to see from them to make it easier for you to commitment to high performance or easier to achieve those goals?

So I will leave that up for folks to ponder on and to fill in. While we do that I'm gonna tease up another question we've received to the panelist. So let's see here. Here's one. "Can you provide an example of a zero energy aspect that furthered the owners security requirements?" It's kind of a tough one. Throw you guys a little bit

of a curve ball, but interesting. I will say that we've been doing some work with schools and I know one of the big concerns for schools that's come up is very unfortunately around shooter safety and things and that being a big concern for schools and their construction. Which is sad on a lot of levels, but a reality. And so I think that's one area potential intersection, but I'll turn it over to you all if you have some solutions to share here.

*Stet Stanborn:*

I would add one example that we try to do in parallel. So we do quite a bit of governmental work for Department of General Services for various governmental buildings both at the state levels and at the federal level. Obviously there's a lot of security requirements around blast protection from the building and closure standpoint. As buildings are going through retrofit needs to meet new security threats, we use that as a parallel time to also be looking at the same façade enhancements from an energy enhancement standpoint.

So can that same enclosure that you need to do from a security standpoint – you're gonna still do a retrofit. Can you at the same time be boosting that for better low E performance, spectrally selective coatings as part of your built up IGU that still has fragment containment and all the things around security, but can we also get the high performance? Can we still do it thermally broken? Can we still do spaced out support clips rather than continuous bars? It's really a deep dive on the engineering side of that safe façade system, but at the same time not forgetting that energy is a huge threat as well.

There's a climate threat at the same time, not just blast protection. So we try to pair up those renovations to be dual use. So we're not saying do this one thing, spend a whole bunch of money on a façade re-skinning of the building. Oh, by the way, now we need to go do an energy efficiency update. If you can do those things the best time you'll get the best value out of the capital investment.

*Ryan Jang:*

I think another way the interior of the building – and again, it depends on the building program, but we've been working on a number of engineering lab buildings recently and the HVAC systems and air handling systems within different programmatic needs of the building vary within the building. The reception area, for example, is different than the open office write up area and more intensive than that might be a dry lab. Then more intensive than that might be a wet lab.

So there's this idea of different energy needs depending on the program and we've actually found recently – of course one strategy I guess around the HVAC there is cascading air in and other things like that. But it's an interesting question because then it makes me wonder how we can more and more bridge that with programmatic and security needs of that same building and there seems to be a parallel track where there's a public space that actually is well-connected to the outdoors. It doesn't need a lot of energy. And there are other areas that are very private and very secure because of the research being done in them and to link those two things I think is something – the question means that we should think about those more in our projects and it just is a very interesting question.

*Ryan Poole:*

Yeah. Sarah, I'd just add too one simple example that comes to mind for me particularly with schools, but a lot of buildings, and vestibule areas, your entrance way. You develop it for security, but I don't think people realize if you have that vestibule space it helps keep the air contained so you're not losing a ton of your conditioned air whenever you're having people go in and out of the entry way. So you have it for security purposes so that you can keep an intruder locked in a space before getting through the second space, but it also helps significantly reduce your energy load so you don't have a bunch of your conditioned air moving in and out of a space.

One other thing that comes to mind for me that's probably the biggest for security is I'm gonna go back to resiliency on all this. It's looking at it from a different security perspective maybe, but security of your assets, security of power moving forward. A lot of us have talked about office and stuff, but we have really large data center projects and health care projects and life science, pharmaceutical projects, you name it, that are also going towards zero ready with big battery back-up systems so that they can be resilient and power through if they get into a situation like we had in Texas where PV system was not capable and ready of handling the cold conditions that we got. There was a lot of loss of power and people wanted to know how do we prevent this from happening again. How do we continue to drive towards resiliency and net zero energy ready is the answer.

*Sarah Zaleski:*

Thank you. Great answers again.

*Paul Torcellini:*

Sarah, I don't know if we can go back to that last word cloud or not, but I think there's some opportunity here that was coming from the owners and maybe the panel could respond to some of these. Especially convince us. Give me more examples. Can the

panel respond to some of these words and how the AEC community is ready to respond to this.

*Stet Stanborn:*

I'll just share, 'cause I saw the include financing options. So one of the things that we've seen and picked up on recently is especially on the resilience side I'm trying to find ways to help package net zero energy, low EUI and resiliency all as one product, is looking not just at the financing side, but also talking to some of the large insurance carriers and reinsurers. So the insurance companies for the insurance companies up until a few years ago I didn't know that was a thing.

But as I've been diving a lot more into this is actually talking with the reinsurers and trying to find actual are they willing to provide a high resiliency product for projects that are going after these really high aspirational resiliency and low energy goals so that the insurance premium is lower because the risk to that project has been taken on to a certain extent by the owner whether it's for wild fire, power outages, flooding. Can we reshape the financial market and talk to your actual insurance tree and talk to them about whether they have a product that's based on low energy and resilience? More of the global insurance sector is looking at this really hard right now.

So we're sort of a trusted partner going with you and talking to, both from the financing side and insurance side, on what is the risk analysis for the project and how have we mitigated that and to what extent? So it's similar to size seismic retrofits, but if you're in seismic country we've had to do that for years and there's benefits on the insurance side if you've gone through a thorough seismic retrofit. So I'd say we don't wanna just look at finance, but also look at the full financial picture of a project and what its monthly costs are, where the premiums are going, and can any of those entities provide an incentive to do those low energy buildings.

*Sarah Zaleski:*

That's great.

*Ryan Jang:*

Another way to that term, convince us, it's a great point. And I think is developing alternates through design process and through the bidding process regardless of your project delivery. So one way to be convincing is to propose something. We're all in this because we wanna be creative about these things and we'll put those ideas out there. They need to be costed from a first cost and affordability perspective as shown here in green. They need to be done in a collaborative way with our contracting and build our partners. And you need to understand the energy return on it also.

So then if you have a series or a menu of alternates that get well-defined over the design process as you move towards your GMP or move towards construction or whatnot, then you can pick and choose those I think within the design as it moves along depending on what the priority is and you can choose by advantage depending on what is most important and how much resource you have.

*Sarah Zaleski:*

That's great. Thank you. I think we're gonna go – we have a few more minutes for discussion and polls. There was another poll I was hoping we could ask for attendees to respond to. This is really – I noticed when we asked initially how many designers there were on the call there was quite a few. So we have a question for you all. If we can go to that on the Slido poll. Is what would you as either an architecture, engineer, construction firm like to see from building owners? We heard from three examples of these with the Ryan's and Stet, but for other folks that are on the line we'd love to hear from you too through Word Cloud.

While we do that I will go to another question that was submitted through Slido. So here's a question about demand flexibility and design. So we talk a lot about EUI and the importance of EUI goals and efficiency, but there's also a time element to when you're using energy both from a cost and emissions standpoint. So any suggestions that you have or any techniques you've used to look at shifting time of use to lower carbon intensive, lower expensive times on the grid?

*Ryan Poole:*

Yeah. Stet, I'm gonna let you jump in. I had one point. I think it goes over so well to this, which was the other piece that we're really great at helping you with is negotiations with your local energy provider so that you can understand how to best utilize your system. This is new conversation with a lot of energy providers too, right, specific areas. So it can sometimes be a little daunting for them to understand.

Oh, you wanna build a one mega lot power system and you wanna feed load shed back into the grid so that you can make your system more affordable. So there are those strategies as well that you can look into for continued return on investments, perpetual revenue stream from your actual energy system as well. So I think that will tee you, Stet.

*Sarah Zaleski:*

Thanks, Ryan. And Stet, I know you could talk about this for hours because you're very well-versed on this. If I could just give you a

minute or two so we can get to the last couple questions. Thank you.

*Stet Stanborn:*

Yeah. I'll go super fast. I'd say if there are two frameworks that you're super interested in you can do a Google of GEBs, G-E-B, which is grid efficient – or grid connected efficient buildings. It's a framework right now talking about how friendly your building is to the grid and how – and strategies for load shifting. The other one is Grid Optimal from New Buildings Institute. They're both really great frameworks to help you navigate ways that your building can look at what we call shift – load shift, load shed, and low shimmy, different scales of how grid interactive your building is.

I'd also say – so there's a hold world of demand response and there's companies now that will actually take your demand response capacity of your building and aggregate that with a whole birch of other buildings to create a portfolio that they can actually negotiate with the utility for large scale load shifting. Then you get an actual – it becomes a commodity or a tradeable asset. So you can actually take advantage of that and get paid for that ability. The last thing I'll put a big shot out for is taking advantage of the mass of your building.

Specifically, if you have a high mass radiant floor used for either heating or cooling, that mass – there's a bunch of research that's come out and some field studies that have shown you can actually shift your heating and cooling load over for more than 12 hours by taking advantage of the thermal mass of that slab. So you can actually run your equipment when it's grid friendly, when it's carbon friendly, or when it's outside temperature friendly to get the highest performance and rely on the building mass itself to actually provide a tremendous amount of load. So I'll cut it there because I know there's lots of questions, but if anyone is interested I could talk about grid connected buildings and load shifting for days.

*Sarah Zaleski:*

That's wonderful. Thank you, Stet. Very tangible pieces of advice and guidance documents. And I appreciate you also mentioning not just the active control side of things, but also the passive strategies that can be help from there too. So we're gonna – I'm gonna ask one more Slido question and Mike, if maybe we can go to not the next one, but the last one for folks. So the last question is from this session, what are you going to do perhaps differently given the information that you've heard on this call? And we'll just leave this up for a couple of minutes here.

After this we're gonna have a couple of minutes. I'll let folks continue to respond here, but we're gonna try to summarize some of the tips that we heard for both owners to work towards these low carbon, low energy goals working with their teams as well as some tips for designers and contractor's summary. Then we also have a number of additional resources with links at the end which will obviously be a part of what's cataloged on this session and I think some of the things that get to more of the details around how do you pick an EUI target to include in an RFP if you want to.

What – how would you find an appropriate target and how would you go about integrating some of this into procurement and selection? So we'll have some resources there folks can follow-up on. So great. I love seeing that other folks might be interested in joining the allies program. Great to hear about the action plan to get to zero energy, zero carbon and looking at really measuring the EUI's of buildings in the portfolio. This is great. Thank you all for participating with us through that. So for the last few minutes I'm gonna turn it over to Paul to talk about a few of the tips for both owners and designers and contractors.

*Paul Torcellini:*

Sure. Thanks, Sarah. So I think we've heard a lot of these things and there are definitely resources out there. You contact us for some of these resources, but on the owner's side, ask for energy performance and ask for what you want and ask for it early and keep true to that course. I think there were some questions on there about that communication and I think if we had asked the panel about that they would all say, "Yeah. Give us EUI targets. Give us those boundaries that we can meet as part of that and include those goals in procurement documents. Hire a design team and the contractor that then will deliver to that energy goal and deliver in a price that makes business sense for you."

As you're looking for design teams and contractors, ask them for what past EUI performance they've had. How did buildings work in the past? One of the things that we are encouraging through this is that designers have – go back and ask for some of that data and that works for two ways. Owners need to be willing to share a lot of that information especially on these highly successful projects to show others that it can be done and we saw some of that in some of the Word Cloud pieces. Be willing to spend more money and design and use some of that and show that better design, if you plan it better you're going to save money on the construction side.

So it's much easier to make changes on paper with a pencil and eraser than it is to change the way the concrete was poured or to

change something about a building after the fact. We heard some discussion earlier about what is the total cost of ownership of projects and that can be operational costs, it can be first costs. The panel also brought in things like insurance costs and just a lower risk that if the grid goes down what's my potential risk and exposure there.

So next slide. And then looking at the design and contractor side of this, some of this is even if owners don't necessarily ask for the – send energy goals for all projects, make it a challenge as a firm that you're gonna do this. We – many of the questions that came up, we just touched on one or two of those, had to do with costs. Cost comes up over and over again, but that we can achieve zero for little or no additional costs. There are more and more case studies coming out around this.

We had done some work last summer on the cost of K-12 schools and found that the energy performance of that building was really decoupled from the cost of that building. The more data we can collect on that, that's some of the “Convince Me” I think that came up in the Word Cloud. So the more transparency with the data, the more people sharing that data will really help move this industry forward. As for energy performance on all projects, I made a comment about this a minute ago that as a designer say, well, how did that work? What things worked well? What things didn't work well? Always be ready to provide design alternatives to get to zero.

Start – use that as a starting point. What strategies can I use to get there? One of the things that we have been finding and one of the panelists mentioned earlier was the huge decrease in the drop of renewables and especially photovoltaics on buildings to the point that it is – the incremental cost of putting photovoltaics on is often less than a lot of other uncertainties we have about a project including the overall cost estimate. So as a rule of thumb, renewables should be an add alternate on every project. And then work together as a team between the designer, the contractor, and the owner. So next slide.

*Sarah Zaleski:* Thank you, Paul.

*Paul Torcellini:* Yeah. So we've talked about these programs and I'll turn it back over to Sarah, but here's some links if you're interested in some of the efforts through Better Buildings.

*Sarah Zaleski:* Yeah. Thanks, Paul. So I think most folks have heard by now that we are excited the Secretary announced the low carbon pilot for

building owners to commit to a couple of their buildings to low carbon goals. So if folks are interested in that, there's the link. Then if you're interested in the design and construction allies either as an owner to find out more about these firms and how to work with them and some of the strategies they're using or as a firm to join, there is that link.

And the next slide, there are a bunch of resources. I realize folks wanna take a screen shot here or this will obviously be archived with the session, but to support a lot of the strategies that we heard about and these are both the soft skills of how do you sell this and how do you do the procurement to some of the more technical aspects too can be found here in some of these resources. I know we just have one more minute. So I'll cruise through this. So we will *[break in audio]* webinar series this summer with lots of great topics found here more in the Better Buildings Solution Center.

All of this and more can be found on the Better Buildings Solution Center. I guess as the final slide I just really wanna thank our panelists and all of our attendees from a great session. We've launched a short feedback survey in Slido if folks would be so kind to spend 30 seconds to let us know what you thought about this session, what we can do more in this space. Your answers are totally invisible to other attendees. I really just wanna thank everybody for joining us today, spending the time. Please check out the Better Buildings Solution Center and feel free to reach out to me, Paul, or Sammy with any questions or ways that you'd wanna work together in the future. So thanks, everybody, and good luck for the rest of the Summit. Take care.

*[End of Audio]*