

Designed to Deliver Lessons Learned from Architects Engineers and Contractors in Zero-Carbon Buildings

Paul Torcellini, Paul Hutton, Kiersten Washle, Patty Lloyd

Paul Torcellini: I thank you for joining the webinar today. We're going to give folks another minute or two to join and log in. I will be starting soon.

[Break in audio from 0:00:22 to 0:02:23]

Paul Torcellini: All right, let's get started. Hello, everyone, and welcome to the 2022-23 Better Buildings webinar series dedicated to bringing you the latest actionable insights from leading industry experts. This annual series is a chance to explore the topics, technologies, and trends that affect your organization as well as efforts to accelerate decarbonization and energy efficiency adoption.

Today's webinar is called "Designed to Deliver: Lessons Learned from Architects, Engineers, and Contractors in Zero-Carbon Buildings." Architects, engineers and contractors are essential in designing and delivering buildings in order to offer top value to clients while meeting energy and carbon goals. Today's discussion is looking at the relationship between those who deliver buildings, such as architects, engineers, and contractors, and building owners. It largely is a result of the efforts of the Better Buildings design and construction allies, a part of Better Buildings that is working to overcome industry barriers and to promote the routine delivery of zero-energy and zero-carbon buildings. It is an opportunity to hear insights from leading contributors from the architecture, engineering, and construction industries.

Today we have Paul Hutton from Cunningham Group, Kiersten Washle from CMTA, and Patty Lloyd from Leopardo Companies. Each will share their unique real-world insights in what it takes to achieve energy and carbon reduction goals. But before we dive in, here are a few housekeeping points I would like to cover. Please note today's webinar will be recorded and archived on the Better Buildings Solution Center. We will follow up when today's recording and slides are made available. Next, attendees are in listen-only mode, meaning your microphones are muted. If you experience any audio or visual issues throughout the webinar, please send a message in the Q&A box located at the bottom of your Zoom panel.

My name's Paul Torcellini, and I am your moderator for today. I'm a principal engineer at the National Renewable Energy Lab and work with the Better Buildings design and construction allies as well as technical aspects of the Better Climate Challenge. We will start today with some polls using the Slido platform and have short

presentations from an architect, engineer, and a contractor. From then we'll move to a panel discussion followed by questions from you, our audience. If you're interested in joining the design and construction allies and are involved directly in the design and delivery of buildings, that is design professionals who perhaps stamp drawings or a contractor that is actively building buildings, we'll provide a link in the additional resources near the end of the webinar.

So a little bit about the design and construction allies. It was formed really to meet a gap between what owners were desiring for buildings and getting design professionals and contractors aligned with that. And so today we're going to hear about some of the gaps that the group has discovered and worked through. Really the goal and the challenge of this – a challenge that I give to this group is what is stopping you from routinely designing, delivering these zero-ready buildings every day in every project? And then trying to identify and address those barriers. We have about 23 firms that are currently participating, and the website for the allies is on the screen now. As we identify those barriers, we form working groups which look to identify solutions and then implement those solutions in their firms as they work with clients like some of you in our audience. Once we do that, then the objective is to disseminate and try to scale those solutions.

So at this time, we'd like you to go to [slido.com](https://www.slido.com), which is the interactive polling platform that we're going to be using. So please go to [slido.com](https://www.slido.com) on your mobile device or opening a new window in your internet browser. Today's event code is #DOE. If you'd like to ask our panelists questions, please submit them any time through the presentation on this platform. We'll be answering your questions near the end of the webinar. You can also select the thumbs up icon for questions that you like that somebody else submitted, which will result in the most popular questions moving to the top of the queue. Before we start and to get you a little warmed up on Slido, we want to start with some polls today. First we want to learn a little bit about you today. So on the screen you have the polls. The first one is to describe your organization, and there are some options there that are available. So great. It looks like we're actually pretty evenly distributed between our different kind of partner and sectors, and we also have about a quarter of the audience is in kind of that design delivery process for buildings. That is great that we have this broad spectrum of you on the line today to enjoy this discussion.

So now we're going to ask you some specific questions about what you're implementing, and the first one is have you ever implemented low-carbon technologies in your building portfolio. Definitely applaud the kind of small group there that actually is doing this in every building project they have, and certainly we'd like to hear from you in the Q&A time with your questions or comments on how you achieve that. and it looks like many of you, over half, have started thinking about this and have implemented it a couple times. And again, feel free to challenge our panel with some of your barriers and let's hear from their responses as they come back. We'll give this just a couple more seconds here. All right, I think we can move on to the third poll question.

What is your primary motivation for implementing low-carbon technologies? Roughly half of you are doing it to meet a corporate climate or greenhouse gas target. Or maybe your organization doesn't have a target and you're still engaging with those and moving your organization in that direction. So I'd say about a quarter seem to fit into that category. All right, well thank you very much. So let's move on. I think there's one more. And this is a little bit more specific. And we're curious have you used heat pumps for HVAC systems. Realizing that a lot of times, especially for Scope 1, the onsite fossil fuels that are consumed primarily for heating buildings that heat pumps are one option for that, so curious on how many of you have thought about that. More than half have, so that's very encouraging, again thinking about those technologies and how to use them.

All right, so with that, let's move into some of the content here, and we have a great lineup of presenters with some short presentations today. Paul Hutton joins us. He is the Director of Regenerative Design for Cunningham, a large international design firm. He guides the company's efforts to deliver regenerative projects in healthcare, hospitality, education, workplace, and multifamily housing sectors. Under his guidance, the firm's portfolio has achieved energy reduction 56 percent below baseline. He has been a practicing architect for more than 40 years, during which time his projects have pushed the envelope for energy efficiency, daylighting sustainability, and resilience.

Next we have Patty Lloyd. Patty has almost 20 years of experience advancing sustainability in the built environment. She's an advocate for green building and healthy high-performance construction. She leads Leopardo's corporate sustainability efforts as well as contributing to all sustainable projects within the firm.

She has served in many leadership roles in the green building industry, currently sitting on the USGBC technical committee and the AIA Illinois board of directors. Formerly, she was a board member and chair of the Illinois Green Alliance, USGBC materials and resources TAG, facilitates the Chicago Living Future Community, and volunteers on several working groups. She is a LEED Fellow, LFA, and Well AP.

And finally we have Kiersten Washle. She's a building science engineer with CMTA's Boston office. She has a Bachelor of Science degree in system engineering and sustainability and a master's in engineering management as well as an MBA. She collaborates with building owners, utility companies, and third parties to benchmark, analyze, and design new and retrofit high-performance buildings. She has been featured at national conferences like the 2022 ASHRA winter conference, and most recently the Net Zero 2022 conference where she has spoken on sustainable design topics like zero energy and decarbonization. She was recently named Emergency Change Agent of the Year by Built Environment Plus. So thanks to the three of you for being with us today. And with that, I'm going to hand it off first to Paul Hutton, and please kick us off today.

Paul Hutton:

All right. Good morning. I'm very excited to be here, also honored to be part of this really top-notch group with a fellow engineer and contractor. A brief moment about Cunningham. I promise to keep this brief just to give you some context of what kind of projects I work on. We have these five studios. You can see them listed there along with some of the typical project types. I just want to make quick note that some of our clients do in fact push us toward net-zero carbon, and that's great. We love those opportunities, but by and large it's our job at Cunningham to be the change agent, to be actively promoting the push toward net-zero energy and net-zero carbon. So let's go ahead and go to the next slide, please.

As we were preparing for this webinar, our friends at the DOE asked us some really great questions, and I chose to organize my brief presentation here around three of those questions that they asked us and a few of what I think are the top responses that you might hear about. So the first question was what I wish my clients knew. This list could easily be so much longer. I'm not going to go through each of those in detail. We don't have time. I'll let you just absorb what's on the screen there, but there are a couple that I would like to touch on briefly.

The first one would be that second bullet down. It's not just the engineers. And I put this one on the slide because so often I encounter clients who believe that if we use LED lighting designed by our electrical engineers and we have a great mechanical system, maybe with heat pumps, Paul, designed by our mechanical engineers, that's it. That's what you have to do. And I have to let our clients know it takes a lot more than that. It takes an entire team starting with the architect, including the engineers, and very importantly also including your contractor to get to net zero. So it's not just the engineers; the architects have a role to play too. And very importantly, I've seen many projects that have fantastic engineering teams that haven't gotten to net zero, partly because the architect on that team wasn't up to it.

The other thing I want to mention is that fourth bullet point down. If you don't model it, you won't achieve it. We have great tools at our disposal at our firm and most firms these days. It's so important to use performance modeling to check how we're doing it every step of the way along the process. If we only model when we're getting near the end, that is not a recipe for getting to net zero.

This is the next question they asked us. How can you work with your design team to achieve better results? And I'm going to start right with that first one here. Don't rush into design. I see this happening so often. We really encourage our clients to start the overall design process with a workshop in which we talk about what are the possibilities, the strategies that we might consider to implement to get to our energy and carbon goals. And what I've seen happening is when the design is allowed to get started prematurely, before those goals have been together put into place, that first design vision sticks. It's hard to get rid of it once it's out there. So I really work hard to get our projects and our teams to have the patience to work out the goals and then start the design process.

I want to hit that fourth bullet point next. Consider new systems and materials. I see so many great designs get stymied because clients have fear around systems and materials they haven't used before. If your design team brings these kind of things to you, give it a fair hearing. If you need to do some research, if you need to go visit a project where they've been used or talk to other clients who tried them out, do that, but don't just shut things down because they may be unfamiliar to you. Your design team you've hired for a reason. They have good ideas. You need to hear them out.

And how about the last line of my group here, the next one. What should you ask your architect? I get the opportunity to go to a lot of interviews and respond to a lot of RFPs, and unfortunately what I see is so many of the questions we get asked tend to be repeats from previous projects. They're generic questions. If you have zero-carbon or zero-energy goals, be really up front with your architect and design team and ask them what strategies have you used before to achieve these kind of goals. Which of these strategies do you think might be relevant on the project that you have in mind? Don't be afraid to put the design team on the spot and ask those kind of hard questions. I'm convinced that the answers you get will tell you a lot about their readiness and capability to help you make it to that end goal.

And I think the last one that I wanted to hit on here was how will energy modeling be used to impact your design process? That goes back a little bit to that earlier point, but it's so important to us that the energy modeling isn't just something we do at the end to see where we are but we use it at every step of the way to measure our progress. In fact, at Cunningham Group, we have within every one of our document sets one whole sheet that's dedicated to recording how that design is currently standing in regard to energy use, water use, and carbon emissions. So we think it's really important to have that be a tool that you use on a regular basis. And I think that should be just about my five minutes.

Patty Lloyd:

All right, so it looks like I'm up. Thank you, Paul, for the introduction. As he said, my name's Kiersten Washle and I'm a building science engineer with CMTA. Really excited to be here today with Paul, Paul, and Patty, but a bit more about CMTA before I talk about my lessons learned. So we are a national firm. We have about 30 offices, and green building is really our bread and butter. We have almost 10 million square feet of zero-energy design that's operating right now. We've done 200-plus Energy Star projects. We have 75-plus megawatts of solar installation, and miles and miles of geothermal well fields also in operation. We work across most market verticals with the exception, perhaps, of residential, and we focus not only on MEP design but also advanced commissioning, sustainability consulting, and performance contracting.

So this is just a little bit more about CMTA but to speak to the audience here today which I saw was heavily government owners and majority contractors and consultants, we really often come across the question is it possible to retrofit something to net-zero

energy or zero operational carbon, and this slide is really just a resounding yes, it is. So what you're looking at if you can't read it on your screen, the gray bars are operating EUIs from before a retrofit project, and then the green are those same projects after we've done a retrofit design. So we drop anywhere from 149 is the highest before EUI down to a 46, and then we get as low as about a 22 – or no, a 20 rather. So it is possible even in existing buildings, and we'll talk more about that later I'm sure.

So the things that I wish my clients knew, I think – I hope at least it'll be comforting that some of these points echo Paul's, and I'm sure some of Patty's will echo mine. So the message at least should be very clear. My first point is set the correct project goals and select the right team, and what I'm getting at here is being really clear with what you're aiming to achieve. So do you want it to be zero carbon? Do you want it to be zero energy? Do you only want a LEED sticker or an energy star? Making those really, really clear, including them in the RFP, that's really going to help you from the get-go. And then going into selecting the right team, you don't want to be someone's experiment, so getting the right team that's onboard with those goals, has experience designing that type of building is really, really going to help you in the end because they can walk you through and educate in addition to designing what you're looking to get designed, and I think that this just really amplifies your chances of success.

Next up I have utilize resources out there, so there are a ton of things if you're not sure where to start that could begin. So there are the advanced energy design guides, which are publicly available through the ASHRA site but was a coordination with NREL and the DOE, so the same folks putting on this webinar today. And in addition to sort of how to design and what's a green building, there's a lot of funding available if your building project includes these types of goals. There's the IRA, there's perhaps local utility programs. So you don't want to forget that these things are out there and could potentially sway the path of your project if you do or don't utilize them.

Next up I have sharpen your pencils. So a lot of times, we see conservative numbers, which there's a time and a place. We don't want structural engineers to not be conservative. However, if your electrical engineer is rounding up for the NEC code and then also giving the potential for additions later on, you end up with a much larger service size than perhaps you need, and that money could be spent somewhere else on a more efficient HVAC system so that

you don't need to upsize your service. There are different tradeoffs, so just being really exact with when you're doing your design, and this applies to cost estimates as well. So when I talked about selecting the right team, I said it's important for them to have experience.

For instance, at CMTA, we do internal data tracking for all our projects, so we have a pretty good idea of the performance of our portfolio post-design, and with that data, when we do new design projects, we have this great base that we can compare against. So if we get an estimate from a contractor who hasn't done, let's say, a well field with a geothermal ground source heat pump system before, likely they're just going to market it up because it's unfamiliar to them, and that can start to skew the decision-making process if you're looking at costs, which who doesn't look at costs. So we find it very important to work with all of the contractors and all the team and make sure that what we're seeing is what's in alignment with the reality, and a lot of times we can sort of cross off some things in those cost estimates. So that's important to just be aware of.

And lastly, it doesn't have to cost more. So you can do net zero at cost parity. You can do it in an existing building. It's just how you focus, setting your goals from the beginning, and then understanding where to spend the money, so perhaps you do buy a more efficient system, but then you don't have to buy as much solar on the back end to reach a net zero energy goal, for example. I think that wraps it up. I'll hand it over to Patty.

Patty Lloyd:

Thanks, Kiersten. Good to see everybody today. I'm Patty Lloyd, Director of Sustainability at Leopardo Companies, as Paul introduced me earlier. A couple things about Leopardo. We're a family-owned company. We were founded in 1977. We're working in a lot of key markets like multifamily residential, tenant interiors, corporate community, labs and industrial, and more. We currently have three offices in the US. We're based in Chicagoland, so I'm sitting here from Hoffman Estates, Illinois, and we've got projects all over the country right now, so it's really exciting. I personally am coming up on my 19-year anniversary with the company. Since I've started in this role, I've seen incredible growth in the industry as it relates to healthy, high-performing buildings, and it's so awesome to be sitting here with you all talking about net zero buildings. When I started on our first LEED job in 2005, I don't think anybody was talking at net zero, so it's really great to talk to you about how we can work together to accelerate and uptake what

is an incredibly important metamorphosis of our industry that has to happen.

What I wish my clients knew, so I have a lot of words up here but I'll make it brief. Energy efficiency tax credits, rebates, and incentives, those are all delivered after the project is built, so just kind of the idea of these impact the construction budget negatively often because owners want – don't understand that that's not going to come off the construction costs. As a builder, we still have to fully pay for all the materials, all the labor, and fully bid the job.

So just understanding that those are going to come later and that really, you know, you could also change your viewpoint to look at it as a lifecycle cost rather than a first cost. As we're embarking on this new type of high-efficiency buildings, we're still running into a lot of conventional ideas about first costs, and as a sustainability professional, it's really frustrating because oftentimes the clients don't understand the significant lifecycle savings costs they're going to have over the lifetime of their building by investing in that higher first cost to have high-performing building.

I think Paul has said this and Kiersten has said this, certain contract types are better than others at facilitating collaboration, particularly from our seat at the table as the general contractor. There's never enough education for all the stakeholders, the contractors, the subcontractors, the vendors, the building owners, the building operators. We need to popularize education across the industry because it will help us reach our aims more quickly and efficiently.

Ongoing commissioning. I think this was also said. You can't just set it and forget it. High-performance buildings have a lot of high-tech things that need to be watched and calibrated, and those systems can be used as a tool to inform future operations. So you can't just set it and forget it because there's actually people that are part of the equation.

Bring on the contractor early. This is critical. Earlier involvement leads to less rework and less redesign, and both of those things actually equal less cost. Solving problems on the front end is so much cheaper than solving them later in the process. We've never, ever – our estimating vice president said this to me, and I laughed and laughed and said I'm going to say this in this panel. We've never had an owner come to us and say, "Oh my gosh, we have more money than we thought. Let's go spend it." So we have to think efficiently about how we spend every dollar.

And don't forget the performance period. Many projects that are seeking a net zero energy certification have a performance period that has to be fulfilled. Sometimes that doesn't start for a couple months after the building is operating, until they hit that first net zero milestone, and then the measurement starts. And so contracts and things like that have to accommodate for that because it's not the conventional contract type or duration, both with your GC and your subs.

So this slide I just love to share everywhere I speak, and it's from Architecture 2030, and it really speaks to why we need to be doing this work, why we need to be working to advance low-emission and low-carbon buildings. And operational carbon is by far the most important initiative to tackle at this time. So if you look at this table on the left, you can see that approximately 40 percent of global carbon emissions are from the built environment, and 28 percent of that is specifically from building operations. The remaining 11 percent are things like the construction process and the embodied carbon of the construction materials.

But looking at this a little deeper, two-thirds of the buildings that are built today are still going to be in operation by 2040. And so there's a huge incentive to tackle this largest part of the building portfolio to become more energy efficient. I think it's like maybe 1 percent of all buildings are new buildings or something like that, so we have to address both the existing buildings in addition to the new buildings to get widespread decarbonization across the industry. Once we start to get those high levels of decarbonization through strategies like net zero building and building operations, then it's really time to turn and look at embodied carbon, which I'm sure a lot of you all have heard of embodied carbon of the building materials, and that's where you're looking at lower carbon concrete or other materials that can bring down total carbon. So I think I have one more slide, please.

One way that owners can kind of advance general uptake across their project team is to work with contractors that you know are already committed to sustainable construction and sustainable measures. We realize as an industry that there's no real benchmark or guidebook for contractors, and so with building green and the sustainable construction leaders, which is a peer network, we created the contractor's commitment to sustainability a couple years ago, and what that does is really create a roadmap for contractors to reduce their impact in the areas that they control. So

for years, people would say to me, "Well, why don't you just convince your owners to build high-performance buildings?" And as the contractor, we're kind of last in line. The building's designed by the time it gets to us, so it's not really something that we can influence, but we can influence how much emissions we're making from our job sites, how we're handling our waste, which is also part of the carbon conversation, so this is one way you can start to work with contractors that are committed to reducing their impact, and I think that was my last slide. Thank you.

Paul Torcellini:

Okay, thanks. That was great from all of our panelists. I do want to move to a time of kind of some questions for the panel. Want to remind you that if you want to join the discussion, you can put questions and comments in Slido.com. Again, the event code is #DOE, and we look forward to kind of continuing this discussion for the rest of the hour.

So, Kiersten, you had mentioned some different goals, and interestingly, we're getting a lot of questions around what is zero? That's one of the high voted ones. Can you talk to the audience, and maybe all three of you can talk to the audience about what you do when you're asked that question around what is zero. I know that there are some definitions out there, there are some frameworks out there. ASHRA has a standard that I think is going to get published this spring, 228. But we're getting a lot of questions about what is zero. We didn't take time to define that even though it was kind of in the title of the presentation, so Kiersten, do you want to start as you kind of led that discussion with a lot of different metrics you talked about, and Paul and Patty, you can join that discussion.

Kiersten Washle:

Absolutely. And apologies for perhaps not defining it sooner. But typically when we say a net-zero energy building, that's defined as a building that produces as much renewable energy onsite as it consumes over the course of a year, so you have an equivalent KBT per year produced that you've consumed, and it is for the full year, so it doesn't necessarily mean month per month you're matching up, which is useful since we have weather changes that would impact your solar production. And in most cases, that offset is through solar.

In terms of net zero emissions, that would need to be an all-electric building. A net zero building could be a net zero emissions building depending on if it was or wasn't all electric or if the client had – and this kind of gets down to what framework are you

adhering to, but if the client had purchased offsets for their carbon footprint. So there are a lot of different definitions, but generally net zero energy is that one I mentioned at the top of the hour. And we use EUI a lot of times when we're starting to design because we can design to a certain EUI. I mentioned on my chart that I showed, typically if we're doing a K-12 school, a net zero EUI falls between the 20 and 25 range of EUI, and EUI is energy use intensity, so that's how efficiently your building is using energy. A lot of people will say it's an equivalent to a miles per gallon for your car but for buildings so that you can compare building to building with one metric. I think that helps. I'll give Paul and Patty a chance to chime in.

Paul Hutton:

That's a great answer. Not much more to add to that. I'll just mention that for us the most common effort is pursuing net zero energy exactly as Kiersten has defined for us. And occasionally we'll have some contractors, perhaps those that have a corporate commitment around carbon, that will want us to also provide calculations or estimates on total carbon emissions that can still be there even in the case of a net zero energy building. So those are the two things that we most commonly deal with at our firm.

Patty Lloyd:

And I would just tag onto that and not discuss the definitions at all but share with the audience some of the ways that we're seeing owners pursuing this, and that's through third-party rating systems. So we've got – there's a few rating systems out there that address zero energy in addition to some that are addressing zero carbon. So we've got LEED Zero, Zero Certified from the International Living Future Institute, LEED Habit Source Zero. In addition, both the Living Future Institute and LEED have a zero-carbon rating system. There could be even more out there, but those are the ones I'm seeing come across my desk.

Paul Torcellini:

Great, thanks. And I think all of this is – all of it is moving in that direction. A lot of this is kind of a directional discussion, and as organizations meet these goals, you're helping them with that. Patty, you had a graph that showed kind of the balance between operational and that embodied carbon, the materials that we use, and I think you stated it was two-thirds of the issue is operational energy. We're definitely getting some questions around finding materials and talking about that embodied carbon. Can all three of you talk a little bit about the balance and how you work on that balance and bring both of those pieces together to reduce carbon impact?

Patty Lloyd:

I can start first by just saying a lot of how we do it from our seat at the table is how are we fulfilling our clients' desires. Are they wanting embodied carbon? Is that their focus? Are they looking at operational carbon? Or is total carbon, which is kind of a combination of those two things, really their perspective? And so we're working closely to identify those while at the same time raising our hand and saying, hey, there's also other types of carbons that aren't conventionally lumped into these things like when you're diverting waste from the landfill or waste to reuse instead of recycling, there's a significant carbon impact there, particularly when you're dealing with thousands of tons of waste. That doesn't usually go into those equations, but it's a carbon impact in addition to jobsite carbon reduction. Those aren't part of your rating system or whatever, but they all add to the greater zero.

Kiersten Washle:

I was just going to say as engineers, I think a lot of the time we focus more on the operational carbon side. That being said, if you get the right team and you're together from the start, it's very much a discussion between the architects and engineers on how you can minimize the embodied as well. But I'll speak to how to minimize the operational, and that is energy efficiency first in everything, and that is always what we preach. We actually have some slides that are a favorite joke to open at conferences at our firm that say any building can be net zero energy, and then there's a dot, dot, dot, if you can afford the solar array. Because as I said, to be net zero, you just have to have an equivalent offset onsite, but solar isn't free, installing those photovoltaic systems isn't free, so what you really want to do to most effectively spend your dollar is minimize your total energy consumed so that that offset shrinks as well. So we always advocate efficiency first, and in doing so you're using less energy in the operation, so you're reducing your operational carbon.

Paul Hutton:

Thanks. I was going to share that I mentioned that we like to kick off our process with a workshop where we talk about these goals. At this point, we've modified that so that we're always mentioning the issue of embodied carbon. What we're finding is that most of our clients are still very behind on this issue. The exceptions to that are probably higher education that really seems to be quite adept at thinking about embodied carbon and some corporations, especially those, again, that have commitments on carbon. But our typical clients are really not there in their understanding or desire to work with embodied carbon, and so that's why we find it necessary for us to do some education at the beginning of the project.

So even when we have clients who aren't really asking us to do much with that issue, we are still typically modeling embodied carbon on our projects. So we have made a commitment starting just last year to model an ever-increasing proportion of our projects all the way through an embodied carbon model. And so that's been a great exercise for us. It's taught us a lot about where the carbon is really showing up in those materials that we use. And we're currently trying to target a reduction somewhere around 20 percent of embodied carbon in our projects, and that's essentially a voluntary effort on the part of Cunningham to try to find products and materials that will allow us to do that.

Paul Torcellini: Thanks. Paul, you kind of just touched on a challenge there, but what other challenges do the three of you hear from your clients around zero energy or decarbonization goals?

Paul Hutton: Patty had her hand up. I wanted to hear what she had to say, and then I'll be glad to jump into that.

Patty Lloyd: I just wanted to say I don't think I fully answered the last question, so speaking to the contractors and the owners out there, a lot of that embodied carbon data comes from a document called Environmental Product Declaration where they've done a lifecycle cost assessment on the product. Those can then feed into things like a whole building lifecycle assessment, and it feeds into tools like the EC3, the embodied carbon and construction calculator tool, which contractors are more and more broadly using to help make procurement decisions on low embodied carbon materials. Okay, sorry Paul, you can hit the next question.

Paul Hutton: I think it was common obstacles. Is that right, Paul?

Paul Torcellini: Yes, common – yeah, you started to talk about challenges, but what do you think some of the biggest challenges that you hear from your clients are that you need to solve?

Paul Hutton: Oh, I think there's no doubt, Paul, that – I'm sure my colleagues will say, especially in this era right now where we have a combination of supply chain challenges as well as rapid escalation in construction costs on the labor and material side both, it's cost, both the perception that these things cost a lot and, in some cases, the reality that there are cost increases related to that. And so I think all of us probably get asked that question on a very regular basis, and so my response to does this increase the cost of the project is it depends. I'm sure, Patty, you probably say that too. It

sort of depends on where the budget is for the project itself. We find on projects that are well budgeted with a creative integrated design process we have a very good chance of getting to a net zero end result. When we have a project that is already struggling on the budget, it's already perhaps underfunded, those can be very difficult projects, and we find we have to get even more creative to find ways to approach those net zero targets. I'm really curious to see what Kiersten and Patty think about these issues right now.

Kiersten Washle: Paul, I was going to say something very similar. I think perception was the word that you said that – right out of my mouth. I think we as designers, we're designing and building buildings every day. An owner might not have that many buildings, so for them it's the lifecycle of a building when they're looking to retrofit or build, and so some of these things, the concepts, they seem a little bit more foreign. And when you hear green, you think expensive. So I just want to emphasize that it can be done at cost parity, and that is really a factor of getting that team together from the start. You can't have an RFP and the building is all the way through CDs, and then you say, "Is net zero feasible?" In that case, no, it's probably not. And if it is, it is going to have an additional cost. But if you have those goals set from the start and people like Paul and myself and Patty can work together for the whole project, I think it's very much feasible and it's not necessarily true that it's going to cost more because we're going to be doing cost shifting, like I said, focusing on energy efficiency first by following that energy, so minimizing your plug loads, lighting, HVAC. If there's a kitchen in the space, that tends to be the most energy intensive per square foot of any building.

So not forgetting any of pieces of the pie for where the energy's going, minimizing them all, and then offsetting, and you end up spending less a lot of times on your equipment, both the renewable but also the size of, like I said at the top of the hour, the electrical services and the HVAC system. If you've right-sized it and you've got a tight envelope, which I think was in another question, yes, we absolutely focus on tightening the envelope before we would put in a new HVAC system. I think it's very much feasible. Patty, do you have anything to add?

Patty Lloyd: I do. I would say that hard bid is a hard sell for a zero project. It is extremely difficult for us to come in at the end as the contractor when you have a fully designed building and an extremely competitive pricing exercise to work successfully to get that project to fruition, and so echoing what everyone else says.

Sometimes it's a barrier because owners don't want to bring us in early for a preconstruction process, and what I would say is that is money well spent. Giving the team together time to work through all the issues on the project and collaborate is actually going to save money in the long run. Value engineering is an exercise at the owner's direction. They've come to us with a price, and we can't price the design at the conventional price that it's been brought in on, and so value engineering is an effort to pare down things to reach the goals. And so when we can all work together, if we're changing the envelope, and Kiersten is adjusting the energy model at the same time Paul's saying which envelope to choose, we're going to achieve our results much faster. Whereas if everybody's operating in a silo on a project type that really requires a lot of collaboration, it's not going to be successful. So getting us in early. We're having a lot of obstacles with supply chain that are beyond all of our controls right now, and that is affecting schedule, so that's some things.

Paul Torcellini:

Yeah, thanks for touching on the question on building thermal envelope overriding other technologies. Can you talk about your role in making the building thermal envelope, and maybe even touch on it from a renovation point of view? How do you make it right and then how do you make it right such that Kiersten can feel comfortable downsizing equipment or Patty feels comfortable installing some downsized equipment because the first call comes back to you at the end of the day. And Paul, obviously you have a big impact on what that envelope looks like and how it behaves. Can you guys talk a little bit about those pieces?

Paul Hutton:

Well, when we're going to design an upgraded envelope, and that's our first choice always is to invest more in the envelope in order to make the mechanical system a little bit downsized, we need to make sure that our client's onboard with commissioning. Because for us to design something and not have that commission, it makes it very tough for Kiersten and her colleagues to do that work on the mechanical system. They have to be able to depend on the actual delivery and performance of that envelope we've put down in our documents. And that's occasionally been a struggle for us. We've had projects where we've not been successful at convincing the rest of the team to invest in commissioning, and it's caused our engineers to have to pull back a little bit, so I can't stress that enough. Envelope commissioning is part of the overall commissioning. It's critical to making this combination of factors successful.

Kiersten Washle: Since Paul spoke more, I think, to a new build, I'll talk a little bit if you're retro commissioning or doing a retrofit. So we love – and this speaks to my know what resources are available to you – we love doing blower door tests and finding the leaks in the building. It's money so, so well spent, to use Patty's words. It's not going to cost you hundreds of thousands of dollars. It might cost you tens of thousands, but then you know exactly where your building is leaking, and that's just hugely important before you go and size your HVAC equipment.

One thing I will say is we have done internal studies from past projects, and we have found there's a point of diminishing returns to retrofit an envelope. So it's important to sort of know your boundaries and, again, spend your dollar in the best place. We found that the biggest bang for your buck comes with a medium-efficiency envelope and a high-efficiency HVAC system. So when you start trying to get walls that are R40 just so that you can have the tiniest HVAC system possible, you start to sort of lose those returns. But if you focus on a good, strong, tight envelope that's just medium grade, you can get those high-efficiency systems and really spend your money in the best way possible.

Patty Lloyd: And if I could just change the vernacular of the industry, I would just change the word commissioning to quality control because that's what it is. It is a quality strategy and it serves the building and the owner through the lifetime of the project. This perceived cost hurdle about commissioning and some of these quality control things are a hurdle that needs to be solved. And then also with quality control, when you get to your builder, as Kiersten was talking about the blower door testing, let's talk about things that seem really simple like high-quality air ceiling, insulation installation, all these things that all come together to really seal up that building and make it tight so that the energy you're paying for is not going straight out the envelope.

Paul Hutton: Paul, I wanted to add just one quick comment on existing building and the envelope because of course architects we're really interested in the envelope. I think the really overlooked opportunity to improve those buildings quickly and simply is the windows. Of course, we'd all like to replace the windows, but that's a lot of embodied carbon that we'd be throwing away in doing so. There are new technologies that emerge, especially those using thin glass coming out of the other technologies like smartphones, 2 and 3 mill glass, that really let you completely rethink the whole window system on an existing building. Even in some cases it

could be a historic structure and still let you achieve those gains. So you can get the equivalent of triple pane actually fairly simply today.

Paul Torcellini: Great. Thanks, Paul. That's actually a good lead-in. Our most upvoted question is actually kind of thinking about what new technologies are out there – and I think, Paul, you just mentioned one. What is coming on the horizon and how does that help us achieve zero? And one way to say it is I think we can do it today. Does it become easier with more technologies, and what do you think those technologies are?

Paul Hutton: Kiersten, do you want to tell us about the magic mechanical system that we're waiting for?

Kiersten Washle: Yeah, the silver bullet. Haven't you guys heard? No, I actually was thinking –

Paul Torcellini: It's free too, right, you can buy it for free?

Kiersten Washle: Yeah. They're giving them away. No, I was thinking about how to answer this question, and I feel like it's unfair to say a heat pump is new, but if we're looking at market uptake, perhaps, we could call it new and innovative, at least in New England, which is where my work is based. You don't see a lot of those systems, but I think that they're hugely helpful, especially when you're talking about a water source heat pump, speaking about another question with how to deal with the peak heating demand and if we require backup combustion. I think with a water source heat pump, even in those cold New England winters, we've been fine. As long as you have that tight envelope and the well-designed system, the backup combustion isn't required. So I think that's a technology that could be more widely utilized, I will say, but maybe isn't new.

Paul Hutton: Yeah, for me it's still the glazing, Paul. That's where I would focus on, where technologies are letting us have a pretty immediate impact on the envelope. It's still tough to take the solid walls of an existing structure and economically upgrade those. And rarely does that happen short of a whole-building renovation. We talked once before about the problem of so many buildings are renovated a suite at a time or maybe a floor at a time, and unfortunately those are what I characterize as shallow rather than deep renovations. And so we tend not to make the improvements we'd like to in the envelope in those situations.

Patty Lloyd:

I'm not going to talk about a new technology but instead just bang the drum really hard on what I feel is just so important. Again, post-construction energy monitoring, so those are technologies that need to be paid attention to more as you're adding more high-tech systems because they'll tell you if there's a gap or if there's a lack or if there's an area, but if your staff that is operating that building is not trained to look at these things and is not trained to pay attention to that in line with the zero goals, they may go ahead and say, "Yeah, Patty, we know you're uncomfortable and you're cold. We're going to adjust it." So people adjusting systems not understanding the zero goals of the buildings can work against the ultimate goals. And so I just really need to say education and monitoring together are such a powerful tool for the ongoing operations.

Paul Torcellini:

And Paul, I wanted to bring out a point that you started down on opaque insulated walls versus windows, that we are nowhere near the thermal performance of a window, even with all the new technologies, compared to a – even a moderately insulated wall. And so that I think becomes part of the design consideration too and balancing those pieces and the costs as well.

Well, I'm going to have one kind of short question here, a little bit different topic here, and it kind of goes back to where the definitions were in that if a zero energy building sells its RECs, renewable energy certificates, and a lot of times you do have the option to sell them or not sell them. A lot of people do because it becomes a revenue stream. What do you do about that in working with your clients because that attribute really has been sold now to somebody else who then buys it to try to take carbon advantage of it and avoiding the double-dipping? How do you talk to clients about that? Or maybe that question hasn't come up for you guys.

Kiersten Washle:

I can jump in. I don't think once we've done a sustainability charette we've had a lot of clients want to do this. I think the only time it's come up for us is when maybe the client didn't understand that that would be double-dipping, and so we just – it goes back to the education of the client and picking a firm that can explain all of these things. If you sell the RECs, yes, you shouldn't technically call yourself a net zero energy building, but there is a perhaps slightly touchy subject of additionality when we're talking about RECs and carbon offsets, and I think this kind of speaks to that. Have you created additionality by installing that solar? You're still doing something good if the answer is yes, but you might not meet the technical definition of net zero. I see the point there.

Paul Torcellini: Anybody else want to comment on that?

Paul Hutton: Yeah, most of our clients are not selling RECs. That's not a situation I've encountered personally with any of our clients in our firm. Where I am hearing a lot about this issue, Paul, is in the regulatory environment. So as you know, I'm right here in Denver, Colorado, and both the city and the state have recent regulations around benchmarking existing buildings, and this issue exactly has come up. What if a building owner installs panels on a building but then sells those RECs? Can they still claim that they are meeting the criteria established in the new benchmarking standards? So it's actually a pretty active and hotly debated question in some regulatory arenas.

Paul Torcellini: Great. And, Paul, you kind of came full circle and mentioned another area we started the discussion around kind of metrics and definitions, and certainly a lot of those regulatory actions are defining them locally and driving certain markets in certain directions as well, so kind of wrapping up on that.

This has been a great discussion. We have only 61 unanswered questions, several that are very popular. We could have this discussion, I think, all day. We're definitely going to take a look at the questions and maybe help formulate what future webinars around this topic would be. This was a little bit different to kind of bring in design teams and contractors to have this discussion with our audience today. So if we could move to the next slide and we'll wrap up here in the next two minutes or so.

If you're interested in learning more, there is a – you can download the additional resources PDF from the chat box, and so that is accessible now. That has just been put into the chat, so please make use of that. It has links on some of the different discussion points that have been made today from the panelists as well as resources available from better buildings and links to other webinars on the topic to learn more.

I do want to bring up the rest of the webinar series, so we are on February 14, so we're making our way through the year. In two weeks, there is another webinar on diversity, equity, and inclusion in climate planning. So again, that is two weeks from today at this same time. And again wanted to mention the Better Buildings summit, which is coming up in April. I would encourage all of you to participate in that and have an opportunity to meet your peers as

well as some of the design and construction allies and hear a whole host of great sessions kind of related to this. There are plenty of engaging sessions for this. If you have not been, it is an incredible experience. It is held in downtown Washington this year. Last year it was in northern Virginia. April 11 through 13. So come explore the session tracks and book your accommodations on the Better Buildings Solution Center.

And with that I'd like to thank our panelists very much for taking the time to be with us today. Feel free to contact the presenters directly with additional questions. And I encourage you to follow the Better Buildings initiative on LinkedIn and Twitter for all the latest news. You can find out our handles by the respective icons on the left side of the slide. You'll also receive an e-mail notice when today's recording, slides, and transcript are available on the Solution Center. And thank you everyone for attending today.

[End of Audio]

Designed to Deliver: Lessons Learned from Architects, Engineers, and Contractors in Zero-Carbon Buildings

Additional Resources

Learn more about the topics discussed on the webinar by visiting the resources below.

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