

Joe Indvik:

Alright. Hello, and welcome to the 2020-2021 Better Buildings Webinar Series. In this series, we profile the best practices of Better Buildings Challenge and Alliance Partners and other organizations working to improve energy efficiency in buildings.

My name is Joe Indvik, and I'm gonna be your host today. And I'm particularly excited to be covering a topic that I think is very timely for a lot of us, and that is the impact of resilience and climate risks on the financial performance of buildings. So, as we've learned over the last few years, natural disasters and other resilience risks have not only a direct physical impact on the built environment, but they also pose transition risks as markets and policymakers increasingly struggle to adapt to the challenge of climate change, and in some cases, as markets are now revaluing assets and services to better reflect those new risks. But at the same time, improving energy and resilience performance, as you're gonna hear from our speakers today, presents a significant opportunity to reduce operating cost as it always has, but also to prevent future risk and to actively manage that risk while improving access to capital.

So, we've gathered a panel with what I think are three really distinct and interesting perspectives on this question of how resilience is likely to impact financial performance of buildings, now and into the future, and I think you're gonna find this both interesting and actionable, so looking forward to it.

If you go to the next slide, my name is Joe Indvik, as I mentioned, I'm the Head of Clean Energy Finance at RE Tech Advisors, which is a consulting firm here in D.C. that specializes in the intersection of sustainability and commercial buildings. I also have the great pleasure of leading the financing sector and the financial allies on behalf of the Department of Energy for the Better Buildings Challenge—so, great to be with you today.

If you go to the next slide, a quick look at what I want to cover, I'll do a quick introduction to this topic and kinda set the stage. We'll spend the bulk of our time on the speaker presentations, which are gonna be about 12 minutes each, and then we'll have plenty of time for Q&A at the end. And just a quick note that we are gonna be recording today's webinar, so you'll have this available online on at the Better Buildings Solution Center as soon as we get it posted.

So, if we go to the next slide, we're excited to be using an interactive platform called Slido for our Q&A. So, to participate in

the Q&A and the poll that we're about to do, go to www.Slido.com, either on a mobile device or by opening a new tab on your web browser, and enter today's event code, which is #DOE, or "pound" DOE if you're among our older audience. And if you'd like to ask our panelists any questions, go ahead and submit them through the Slido any time during the presentation. If it's directed at a particular person, please note that in your question, and we're gonna be answering those towards the end of the session. And then you can also upvote others' questions. If you see one that was already asked that you particularly like, go ahead and upvote that, and we'll try to ask the most popular questions at the end.

So, we have one poll to get things started, which we're gonna do via Slido, so please go ahead and go over to Slido and respond to the poll that you should now see on your screen. And the question is—what sector are you from? You should see it under the Polls tab on Slido. Alright, results are coming in. Interesting, so, we've got a pretty sizable contingent from state, local, and federal governments. Real estate and federal are in a neck and neck race. We've got a variety of other sectors, and a fair number of contractors and service providers working in the built environment as well. And if we scroll down a little bit, it looks like we have some financial services folks, a little bit of nonprofit, industrial, and higher education and multi-family represented. Okay, great, so a good mix of sectors. I think the content will be useful for all of those sectors, so great to have you with us.

So, if we go back to the deck, I just want to do a couple of quick comments here to set the stage and then I'll turn it over to our speakers. I thought it would be helpful to have a sort of table of contents for the themes that we're gonna be discussing, because climate risk, resilience, and financial markets are very complicated. So, we're kind of distilling this down into three areas we're focusing on today.

So, as we all know, climate risk impacts financial markets in a variety of ways, and that in turn can affect the financial performance of commercial buildings. Three specific ways it does that are through credit ratings. So, we now know that, as financial markets and ratings agencies increasingly understand the implications of climate change and resilience, that's gonna start to be reflected in credit ratings, which we're gonna hear about today. Credit underwriting as well, so the way that investors and lenders decide which assets or deals to bring into their portfolio is also increasingly incorporating climate risk factors and resilience

factors into that decision making. And finally, insurance is one of the most direct ways that climate and resilience risk impacts buildings, because it can have the effect of increasing insurance premiums in some cases, and in the worst possible scenarios, making assets uninsurable. So, there are some really interesting and, I think, actionable implications on how this is gonna be affecting the insurance industry and the types and costs of insurance products that are available, which we're gonna talk about.

If you go to the next slide, I do want to briefly introduce an initiative that we launched at the Department of Energy in 2019 called The Finance and Resilience Initiative that kind of sparked this conversation initially. And a lot of the questions we were getting from building owners were things like, you know, "We know that resilience is important. We understand that climate change is gonna have an impact on our portfolios, but we don't really know where to start, what questions to ask, or what process to follow in order to get a good resilience plan in place." So, our goal with this initiative was to bring together experts and emerging best practices who could help answer that question—essentially, equipping building owners with better tools to measure, manage, and mitigate resilience risk in their properties.

And so, by convening this roundtable, six key steps sort of settled out of the conversation, and those are the steps that you see reflected there on the right-hand side, and these are steps that any building owner, whether it's an individual property or a whole portfolio of hundreds or thousands of properties, would be well served to follow as they kind of go down the path of understanding resilience and then making a plan to address it. And so, we sort of collectively called that series of steps The Resilience Roadmap and worked with the DOE roundtable to produce a number of resources, guides, and toolkits on each of those topics.

So, if you go to the next slide, this is now available on the Better Buildings Solution Center. You can go either click the link there, or—I can't click it, but either go to the link there or go to the Solution Center and search for Resilience Roadmap and you'll find it. So, you'll see each of those steps laid out and then you can click into each to drill down to the individual resources and case studies. So, if you want to do a deeper dive into some of the topics that are being covered today or you're just not quite sure where to start on resilience, this would be a good place to go.

Okay, so, if we move to the next slide, I want to briefly introduce our speakers and then I'll give them a chance to introduce themselves more fully when we get to their part of the presentation. But we have Yoon Kim, who is the Managing Director of Four Twenty Seven, which is one of the leading climate risk assessment shops, and is going to be speaking about what they're seeing related to climate risk and its impact on credit ratings.

We've got Ben Harper, who is the Head of Corporate Sustainability for Zurich North America, and was actually a member of that Finance and Resilience Roundtable that I just talked about—so, welcome back, Ben, and thanks for being a part of this. He's gonna speak about how the insurance industry is being impacted by climate risk.

And then we've got Paul Mathew, who's a Staff Scientist and Department Head of the Whole Building Systems at Lawrence Berkeley National Labs, or LBNL, who has authored hundreds of papers—literally hundreds—and reports and is gonna speak in detail on a couple of those, particularly how energy performance intersects with financial markets and the ability of buildings to borrow money.

So, really excited for those three very diverse, but I think all very interesting takes on how resilience is impacting financial performance in buildings.

So, with that, I'm gonna hand it over to Yoon.

Yoon Kim:

Thank you, Joe, for the introduction. And I appreciate the opportunity to speak to you all today. Next slide, please. Next slide, please.

So, first, by way of introduction, some context on Four Twenty Seven. We are a Moody's affiliate company and our focus is on assessing typical climate risk related data. And so, we provide data and analytics related to the exposure of different types of asset classes, including real assets, which encompasses real estate as well as infrastructure and their exposure to physical risks, which I'll talk a little bit more about and help to define in my next slide.

And so, our focus really is on helping to translate the outputs of climate models into decision relevant data and analytics to help the clients that we work with, including some of the world's leading investors, asset managers, commercial banks, development and

finance institutions, corporations and government agencies—to help this broad range of financial and economic factors better understand what physical risk exposure means for their investments.

We're based here in the San Francisco Bay Area in Berkeley, although I'm working from my house in San Francisco itself, and we also have offices in D.C., Paris, Tokyo, as well as representatives in Sydney and in London. Next slide, please.

So, first, to provide some definitions up front. When we talk about climate risk, it falls into two buckets. The first is physical risk, and those encompass both acute as well as chronic risk. Acute includes extreme events of all kinds, including floods, storms, droughts, and wildfires. Chronic refers to the longer term, slower onset changes that we are already starting to see, such as rising temperatures and sea levels. Transition risk refers to the risks that arise as the global economy starts to shift to move away from an economy that's fueled by fossil fuels. And so, this will result in a number of different types of policies as we build technology, market, and reputational risks, and those categories I'll refer to as transition. Next slide, please.

And so, today, I'll be focused on the physical risk side of things, highlighting first here an example related to sea level rise. And so, in terms of types of impacts that we can expect real assets and real estate to face when it comes to climate impact is, first, we can expect to see direct impact to a given building, for instance. And so, that might result in chronic inundation for a given site, flood damage—but then there will also be impacts that have consequences for a given asset, even if that asset is not directly affected. And that will include things like impacts on the infrastructure on which the local community is reliant. And so, potentially, access to transport that enables being able to get in and out of to and from a given building, for instance, as well as water energy infrastructure. There may be other impacts on the broader community that have to do with its demographics and economics, but ultimately, also affect the viability of an asset—assets that continue to be affected by sea level rise impacts and chronic inundation may also find it more difficult to get insurance or to get money for mortgages, for instance, in affected areas.

And so, this will have impacts across the real estate value chain from the direct investors, asset owners, developers, insurers, banks, lenders, and taxpayers. Next slide, please.

And so, I just want to highlight here that climate risk really is already financial risk. And so, two recent examples. The first article, focused on the Carolinas, highlights some work that was done by the First Street Foundation and their analysis, which examined the combined impacts of factors such as tidal flooding, hurricane, storm surge, projected sea level rise, and other elements. And they found that, across the Southeastern coastal states, including Florida, South Carolina, North Carolina, Virginia and Georgia, you are seeing over 616,000 properties that have already lost market value between 2005 and 2016 due to flooding related to sea level rise. And so, that's \$7.4 billion of real estate value depreciation, which is quite significant. That not only has impact for the owners of those homes themselves, those real assets, but also, ultimately, can translate into broader economic impacts that require bailout and call on taxpayer funding as well.

On the right is an article from *The New York Times* which explores the impacts that sea level rise poses to mortgage portfolios. And some of the trends that we're seeing or that the article highlights is that, as lenders become increasingly aware of this risk, they're starting to take measures such as requiring larger down payments up to 40 percent, selling off mortgages to Fannie and Freddie. In particular, we're seeing this type of behavior among smaller regional banks who tend to have a better sense of what's happening on the ground and really helps to highlight in more significant ways the kinds of risks that we're seeing in these areas.

And the longer term implications of this are potentially that homes in these higher risk areas could potentially become unsellable, not just—and I wanna note that it's not just sea level rise that poses a threat of this nature, but you're also seeing this in relation to wildfires across the country, California and the Bay Area where I'm from, or where I currently live, being a prime example of that. And this will have important consequences if we think about homes as being a primary source of equity for Americans. Next slide, please.

So, with this type of risk and the systemic risks that it poses, that climate change poses for the financial system, we're starting to see greater awareness of this amongst investors. On the left is an article highlighting the fact that a number of investors with over a trillion dollars at stake submitted a letter to key U.S. regulators asking them, calling on them to pay more particular attention to climate related risks, recognizing that not paying attention to these and ignoring these could potentially result in a significant and

rapid devaluation of the efforts to underpin the economy and lead to a significant downturn and potentially crash.

On the right is an extract from Larry Fink, the CEO of BlackRock, his 2021 letter to CEOs. And he, last year, in 2020, also highlighted the fact that climate risk poses a material risk to investments. He does the same here, but he, in particular, calls out the fact that we're starting to see a more rapid shift toward climate risk being recognized as financial risk and starting to see significant impact. And that poses both risks for us as well as opportunities. Next slide.

Another important driver that we're seeing to incentivize economic and financial actors to pay closer attention to climate risk is the Task Force on Climate Related Financial Exposures. So, they were created five, six years ago by the Financial Stability Board, and it's a governance framework that advocates for the integration of climate risk in mainstream financial filings, but the TCFD really helped to crystallize an increasing concern amongst investors and business leaders about the potential impacts of climate change on the economy and on financial markets. And so, the TCFD has really played an instrumental role in highlighting the potential, the risk that that climate poses or the economy and financial markets as well as on calling for more transparency and better assessment and disclosure of these types of risks, including their incorporation into major financial disclosures.

And I'll just note that one important thing is, there's both a focus on the risk piece, but also on the opportunities. And so, it will be important to keep in mind that both of these will be presented as the climate continues to change. Next slide, please.

And then more recently, we're starting to see increasing interest and attention on the part of U.S. regulators. So, the Federal Housing Finance Authority, which is responsible for regulating entities like Fannie Mae and Freddie Mac, has recently issued a request for information on climate and natural disaster risk management for these entities that they regulate. So, they're interested in better understanding what the nature of these risks might be that are related to climate, as well as what types of measures they can then potentially put in place to safeguard the system.

The Federal Reserve has also recently established a Climate Committee and has announced that it's going to start integrating

climate risk into its regulatory activities, starting first with things like scenario analysis and stress testing. Next slide.

And then, in addition to these other drivers within the market, we're also starting to see increased interest on the part of credit rating agencies. And here, I wanted, Moody's investor service, in their 2021 Global ESG outlook, highlighted the fact that ESG as well as climate considerations are going to be an increasingly important driver in credit ratings overall, will have an increasingly important impact on credit, so that is a trend that they expect to continue throughout 2021. And so, they have already started to leverage the climate related data and integrated it into their research. And I'm just highlighting one example here on the right from a recent pre-sale report on a commercial mortgage-backed security asset that they evaluated, and they're leveraging Four Twenty Seven data at the asset level in order to understand the exposure of the underlying investment space to physical climate risk. Next slide, please.

And so, I just wanted to spend a few minutes highlighting, we know that climate change poses a risk. What kinds of data do you want to consider to better understand your asset's exposure to climate hazards. Continuing to look at sea level rise as an example—so, the first element is the need to look into the future and use forward looking data to better understand how sea level rise conditions will change over time and what the potential exposure at the asset level will be.

And so, we leverage data that accounts for a number of different drivers of sea level rise, including things like air, ocean, and ice dynamics, elevation data, historical sea levels and then also tidal gauge data for storm surge to understand how, at the project level, so at a granular 90x90 meters, an individual asset could potentially be exposed to sea level rise. Next slide, please.

That enables evaluation at the property level, and here are just a couple of snapshots from our applications, which allow for evaluation both of single sites as well as across portfolios. And on the right, we have an example or an extract from a score card where you can see both the hazard level scores for each of the hazards that we cover as well as the underlying metrics that drive heat stress, for instance, or sea level rise. Next slide, please.

And understanding the exposure of individual assets can be, you can build upon that to develop a market level view. And here, we're just providing a couple of examples of what that can look

like. On the left, we're looking at a distribution of corporate facilities across Europe and the size of the bubble indicates the number of facilities in a given region, and the colors indicate both high risk, with green being low risk and red being higher risk. And so you can see what the distribution of risk within a corporate facility's footprint, for instance, looks like. On the right, we're leveraging data, so another Moody's partner who has a very expensive set of commercial real estate data which we've overlaid with Four Twenty Seven data to understand what some of the key trends within both MSAs as well as subpockets are in the U.S. when it comes to physical climate risk exposure. And here, you can see an example, once again focused on sea level rise for the Atlantic City, New Jersey area. Next slide, please.

And so, I will just leave it at that. I look forward to your questions and engaging with you more throughout the remainder of the webinar. Thank you, Joe.

Joe Indvik:

Awesome. Thank you, Yoon. That was great. I'm gonna hand it over directly to Ben—so, Ben, feel free to jump in.

Ben Harper:

Okay. Thank you, Joe, and I appreciate the opportunity to present here today. My name is Ben Harper, I'm Head of Corporate Sustainability in Zurich North America. Zurich, we're a multinational insurer based out of Switzerland. I think we operate in 210 different countries. In my background, I'm a civil environmental engineer, so I'm still scratching my head, wondering how I ended up in insurance. But as, hopefully, I can show you, it actually touches a lot of everything that we do, and so today, I just want to present more of an insurance perspective when it comes to sustainability and climate change, and how we look at underwriting a sustainable future. So, next slide, please.

So, first in definitions, and clearly, we start off with sustainability and the simplified version that we use is, it means doing business today in a way that safeguards our future in the face of a transforming society. In other words, we want to do business today so that we can do business tomorrow. Next definition?

Resilience, and that's the practice of designing things to endure different shocks and stresses. As an insurer, this is ultimately important to us, because it's our job to help create resiliency and where you don't have resiliency, we're there to endure the physical and the economic shocks and stresses that you may see as an insured through a policy adjustment.

And I think we've got one more definition, and this is environmental, social, and governance, or ESG, and these are the three central factors measuring sustainability and societal impact of a company or a business. And you'll hear me bounce around between some of these definitions. ESG is probably the newest one that some people might not recognize. The old terminology where some people say the old term for this was corporate social responsibility or CSR, but I think it was changed up to ESG, because it's a little more all-encompassing, particularly in the governance or the societal pieces.

So, you'll hear me use those three. I'm not gonna say they're interchangeable, but there is absolutely a lot of overlap. Next slide.

So, as an insurer, how do we look at risks? This doesn't just go for physical risk of buildings, but really, any risk that we look at. And this is from the World Economic Forum. They produce a global report each year. This is the 2019 with a 2020, which just came out a month ago, looks very, very similar. And what I want to point out here—and I apologize if it's tough to read this slide—it's just the interconnected nature of the risk. And that's how we look at things. And if you can read the slide, climate change is the green note in the center or failure to address climate change.

And what can that failure lead to? Well, it can lead to extreme weather events, which translates into water shortages, which affects people migrating, which creates—which can add to the spread of disease and famine and all sorts of other things. So, when we look at a risk, we look at more than just a physical asset on the ground, depending upon the coverages that we provide. And I'm gonna show you a few examples, or I'll discuss a few examples of what I mean by interconnected risk and how we look at things. Next slide.

So, as an insurer, everybody's probably familiar with a lot of the standardized lines that we provide. Most people here are probably concerned with property risk—you know, damage to the structure, damage to infrastructure. And that's a traditional core offering, but we also look at a lot of nontraditional risks, which make up a large part of our portfolio. We look at things like supply chain interruptions. We're ensuring somebody's building a computer or what happens if I can't get the necessary hard drives out of Southeast Asia because of a weather event? Loss of income, trespass, business interruption. Business interruption has been, it's been a very difficult coverage lately to underwrite because of the dramatic changes we've seen in the climate.

And I'll give you an example. And this really is a good example of how risks are interconnected and how we have to look at things more holistically. When Hurricane Sandy hit, we insured a casino that was a brand new facility built to the highest resiliency standards along the Gulf Coast. It survived rather well, and after a week of repairs, they could've actually opened the doors for customers again. And again, we're providing business interruption here. The problem was, is that the roadways leading to that particular hotel casino were completely wiped out.

So, when we say we have to look at risk in a more holistic view, when we start providing some of these additional coverages, which are becoming very commonplace, we have to make sure that we look at the entire system—what can impact that. And that's why things like climate change is so relevant to us as an insurer. Next slide.

So, I just wanted to show you a few charts on the rapid rise in worldwide natural disasters. If you look at this chart, you can see that the trend is definitely way up, and this goes through 2018. I think 2020, some of the data just came out, and it has surpassed 2016 or 2017 as the costliest on record, which surpassed 2010, and on and on and on. So, as you can see, the trend is really pretty unnerving.

And what's just as equally disturbing about this is, if you look at the blue lines as compared to the green, the overall losses. But the blue line is insured losses, and you can see that, while they're definitely on the rise, they're not nearly—it doesn't rise with the magnitude of the disasters. And that is because we do have some control over what we will insure and what we won't insure. But it also goes to show that there's a big insurance gap, and a lot of times, those overall losses occurred to people in the most vulnerable areas—some of the small island developing countries, areas where their economies are just emerging. And these are areas where insurance isn't available as a safeguard or as a risk mitigation factor. And to me, that's as disturbing as the fact that we're just seeing these worldwide natural disasters occur with such intensity and frequency that we have never seen. Next slide.

And this is a similar slide. It just breaks it down by the different disasters. As you can see, meteorological and hydrological events, which I think are very related, hydrological being flood, totally dominate the landscape. But there's other things, too, to consider as well. Here in the U.S. and elsewhere in the world, we've seen a

huge increase in wildfires. And in fact, in the state of California, I believe it's 7 of the 10 largest wildfires that have occurred in California have occurred in the last 15 years. And I get a lot of questions about how that's a climate related issue and when we look at some of the data, we see a few different things. One is that there's a greater frequency of very intense storms, and in fact, I think lightning strikes were up over the past few years like several hundred percent.

So, we're seeing these intense storms occurring with greater frequency, and then on top of it, because of some of the drier climates and some of the warmer climates that have occurred over the last few years, we've seen certain things like invasive beetle species that can consume large swaths of timber and turn them into fuel rather quickly. And they're doing this because the growing season for this beetle, or the reproduction season for the beetle goes from two and a half months now up to six months. So, it's becoming a significant issue, and you can see again the interconnected nature of many more lightning strikes occurring, a drier climate, and now we've got these forests that have been devastated by some of these invasive beetles that are now really ripe to burn. And we see all these things contributing that can be associated with climate. Next slide.

So, you know, why it's important to get these predictions and investments so right, and I wanted to step back for a bit, because I think, I keep talking about, we're at a time where we're seeing things happening with unprecedented frequency, and at the same time, with a lot of irregularity. And so, we're gonna need new tools going forward to assess some of these risks. And one of the biggest perils we face is flood. And I think, too, this is an area that I know a lot of people are already looking at, but there's reasons why we need to get this right, and a lot of it even comes down to just how we interpret data. And for, I think, the longest time, the standard has been, if you're outside of a 100-year flood plain, then that's considered kind of the safe zone for a 30-year mortgage.

Well, the real interpretation is, is that you have, instead of, you have a, 1 out of every 100 years, your area's gonna flood or your building is gonna flood. It's actually, you have a 1 in 100 chance every single year. And so, you look over the life of a mortgage, a 30-year life of a mortgage, and you've got over a 30 percent chance that that structure will see some kind of flood event at some point in its life. And you couple that with some of the alarming numbers that we saw post-Katrina and post-Sandy where you saw a huge number of defaults on loans when there was significant

damage or complete damage of a structure. So, now you can see why it's impacting the lenders. Now, how does that impact other people? Well, as institutional investors—which, insurance are big institutional investors—you know, those were always some of the safer havens for investment vehicles. But as you can see now, we just can't consider the normal norm any more. Next slide.

So, what can we do to assist stakeholders? Well, the first bullet, it's—we always talk about using our skills to send risk-based price signals. And that's a fancy way of saying, you know, our models say that you're a greater risk, so we're gonna charge you more. And we always say—well, the higher cost should incentivize risk reduction. And it can, to a great extent. An example of the insurance industry really being impactful in this area is some of the modern fire codes, when San Francisco kept burning down over and over and over. Finally, some of the insurance, the leading insurance companies went to the city and said—hey, we can't have this any more, so you're gonna have to pass these mandatory fire codes. And that's another way that we can send signals. But we can't just say, “We'll raise the price, we'll raise the price” because at some point, an asset can either become uninsurable or it's simply priced out to where it's not attractive to anybody.

So, you know, championing those governance caps, what can we do to encourage the right behavior in some things? What can we do to encourage not developing certain wildland areas in the California areas that are gonna be prone to wildfire? What can we do to enhance building codes and regulations along coastal areas? So, those are some other things we can try to work on.

We want to push incentive policies that enable to function properly. And I wouldn't say that we see certain policies that work for a while, then maybe they stop working. And incentives are a great tool and then sometimes, incentives are kind of, get a bit stale and they need to be revamped. One example was, I read the other day that Tesla made more from some of the subsidy credits that it received than it ever did from making automobiles. You know, that kinda trend can't continue. It was necessary to get the technology started, but it simply can't continue.

And then the last is, recognize the regional nature of risk. One size doesn't fit all. We understand that climate change impacts people differently, by different geographies and being situated in different areas. So, you know, we recognize the regional nature of the risks and what we can do is try to focus on some downscale modeling and giving people bespoke solutions.

Joe Indvik: Just a quick time check, Ben, you've got about a minute left.

Ben Harper: Okay. Next slide. I think I'm almost done, as well.

So, just real quickly, I guess I've got a minute left. We talked about sustainability and ESG and how sustainability is critical to do business. We want to do things today that allow us to do business tomorrow. Resilience is important. We've looked in the construction arena that every \$1.00 spent on resilience up front saves \$4.00 in post disaster recovery, and clearly risk mitigation is a critical part of that.

And I think the last slide is next, and I'll say if you can take anything from this presentation, it will be this next slide. And it's really, as an insurer, we're trying to make you whole, and as a company, if disaster hits, you want to recover as quick as possible. So, if you look at this graph on the left, the horizontal gray line is the value of a certain asset. If an event happens and, at the timeline across the bottom, clearly, that asset has lost value, and that asset could be your business and you're trying to get back to where you needed to be.

Well, you know, typically, the recovery has been very long and it's getting longer and longer, but what we're trying to do is not only shorten the impact through resiliency, but also shorten recovery time. So, at the end of the day, we're all better off if, instead of being in that triangle that's contained within the gray, but being in that little small red triangle so that we all can continue with business as usual.

And Joe, with that, I'm gonna turn it back over to you and I look forward to the Q&A.

Joe Indvik: Awesome. Thanks very much, Ben. I'm gonna hand it over to Paul, here, in a second, but just a reminder, keep the questions coming. We've only see a few so far, although they are good ones, but please go onto Slido and add some more questions and we'll get to those in about 12 minutes. So, Paul, over to you.

Paul Mathew: Alright. Thank you, Joe, and hello to everyone. Thanks for taking the time out of your day to attend this webinar. My name is Paul Mathew, I'm a Staff Scientist at Lawrence Berkeley National Laboratory. We're not an insurer, we're not even a financial institution, we do work on energy analysis, but fortunately and interestingly, what we've got to do over the last few years is

collaborate with the business school at UC Berkeley, the Haas Business School, on looking at energy risk in commercial mortgages, so we do some of the energy analysis piece and they do some of the financial modeling. I'm happy to share a few findings from that in here and see how it relates to climate risk and resilience as well. Next slide, please.

So, first, kind of 101 in terms of mortgage valuation is that the key metric in mortgage valuation is net operating income, and energy costs, of course, directly affect net operating income. If you look at sort of the conceptual sketch on the right there, you'll see that if you have gross revenues, which is the total size of the bar, you have to subtract operating expenses, and that gives you your net operating income, some of which has to be used for debt service, and the remainder is in fact your before tax cash flow.

So, all other things being equal, a building that ends up using more, having higher energy costs over the course of its mortgage term is gonna have lower net operating income and lower cash flow, before tax cash flow.

So, what are these risks that might happen? They can essentially come from changes in energy use and its volatility over the course of a mortgage term, as well as changes in energy price and its volatility over the course of a mortgage term. And the problem fundamentally is that current practice in mortgage valuation does not fully account for these factors in NOI. They often will use an historical average cost data and almost no one that we're aware of actually accounts for energy cost volatility over the course of the mortgage term and kind of incorporated that into mortgage valuation.

So, these risks are exacerbated with climate change, and they can be mitigated with energy resilience. So, the question is, how much do these risks actually move the needle for NOI and for default risk in commercial mortgages? Next slide, please.

So, our effort with this project is kind of—well, the end goal, really, let me start there, is that energy factors and energy risks are fully and routinely incorporated in commercial mortgage valuation, and that in turn can accelerate the demand for buildings with lower energy risk. It's much like Ben mentioned with insurance, it's about sending a price signal into the market if you properly account for energy risks within commercial mortgage valuation, because they're a huge market and can potentially be a major channel for efficiency and resilience investments.

So, there have been two thrusts to our work, and I'll give you little highlights on both of these. The first is just building the evidence. What do the empirical data actually say about the link between energy costs and mortgage valuation, and the second is an effort to engage with lenders to conduct pilot analyses and so on. Next slide, please.

So, in terms of building the evidence, we've been conducting these empirical analyses with that link default risk to both energy use, measured as EUI as well as actually price, and then looking at what that should mean in terms of mortgage discount rates or origination points in mortgages and the discounts thereof.

We have, I'm not going to—obviously, in the time I have here, I'm just going to present a couple of highlights, but we have a bunch of technical reports there on the website here as indicated. Next slide, please.

Yeah, here's sort of the high level TL;DR, as it were, for the empirical data. We've essentially conducted three empirical analyses over the last few years. In the first, we combined TREPP data, that's a large data set of mortgage performance data, and we combined that with energy benchmarking data from various cities that have benchmarking disclosure laws. Those are just annual energy use data, and we've looked at it for several building types. So, that was the first analysis.

And then the second one was where we combined TREPP data, but this time with more detailed energy monitoring data that we got from an energy monitoring company, but that was just on multi-family. And most recently, we also looked at the Fannie Mae data, which is, again, multi-family focused, and those data have both the mortgage performance data as well as some energy cost data.

The interesting thing is, consistently, across all these three different data sets and analysis that we conducted, we showed a statistically significant relationship between energy use and default rates as well as electricity price and default rates. In this case, it was source EUI, as well as another metric, we constructed a metric called scaled source EUI, where we looked at source EUI essentially divided by NOI, because you know, the lower the NOI, the more important, then, your energy is relative to the amount of NOI. So, in both cases, again, statistically significant as well as the case with the legacy price gap. Next slide, please.

So, that showed that clearly there's a link here, and a statistically significant one as well as economically meaningful. The next question that follows from that, which came from stakeholders, said—alright, what would that mean in terms of how I should price a mortgage differently, given that risk, that link between energy risk and default rates.

So, we did a pricing simulation analysis that essentially prices these mortgages trying to account for these risks, and what comes out of that is the sensitivity, what we calculated out of that was the sensitivity to changes in energy use and what that impact should be in terms of origination points of the mortgage as well as the coupon or the interest rate for the mortgage. And that's what's presented here at a very high level summary for the office and multi-family loans.

So, if you take, for instance, office loans, what it says is that a 1 percent change in source EUI translates into a 2.1 basis point change in interest rate to price the mortgage correctly. So, in principle, an office with 10 percent lower source EUI should get a 21 basis point discount on its mortgage interest rate. That's essentially what that translates into. So, these are sort of economically meaningful numbers. Next slide, please.

So, with that, then we went back and had a conversation with several lenders and what we thought we'd do then—and it piqued their interest, it said that this is clearly something that's material and interesting. And we wanted to do, then, some pilot studies on very specific loans from these lenders, and you can see the lenders listed here on the slide. And the idea was to test some energy risk metrics for underwriting and see where that takes us. So, if you can go to the next slide.

I'll just, again, present a few highlights. We have more technical reports and papers on our website, but I just want to give you a highlight. So, one metric that we came up with, or that we kind of worked into these final studies was what we call a delta DSCR, that's a delta Debt Service Coverage Ratio. Debt Service Coverage Ratio itself is a very well-established metric in mortgage underwriting. It's essentially the ratio of the net operating income to the debt service, and that should always be greater than one. That means you have more net income than you have to pay out in terms of your debt service.

So, what we said is that a delta DSCR is essentially the change in NOI that occurs because of unexpected increases in energy cost,

and mathematically, that's equivalent to the change in energy cost divided by the debt service. So, an example on the right that you see there is, suppose I have a net operating income of 130K, the debt service is 100K, so my Debt Service Coverage Ratio is 1.3, which is pretty good. The usual threshold is about 1.25 that lenders use. Now, if I have an unexpected energy cost increase of about \$7,000.00, that's essentially gonna create a delta DSCR of a 0.07; that kinda drops me below that 1.23.

So, again—conceptually, fairly simple. The trick here is, alright, how do we actually calculate this delta EC? So, if you can go to the next slide. In an ideal world, lenders like to operate off of empirical data and actuarial data. So, in an ideal world, we would have very, very large data sets of how energy use varies in different buildings and from that, based on operational factors, and from that, you could kind of develop probabilistic distributions, right?

Well, we don't have such a data set, so we do the next best thing, which is, we simulate it. So, we've done hundreds of parametric simulations for different building types and locations and sizes and so on, and we can come up with these distributions of how energy use could vary in buildings just based on operational factors, occupancy, system controls, weather, and so on. And from those, you have these quasi-actuarial tables that say, "Well, if you're an office building in New York and you have a certain vintage and you are of a certain size, this is what the ratio of the standard deviation to the mean looks like," and that's your energy risk factor. This essentially becomes a look up table, and you can take the energy costs that you had at the time of mortgage origination, you can take your energy costs for the last year, an average energy cost, and multiply it by that energy risk factor to get your sense for what that tail risk might actually be. So, if you could go to the next slide.

We actually then applied this to several of these pilot loans, and that's what you can see over here. I'm not gonna go line by line, but I'll highlight sort of two rows, here. The one that says MF1 and MF2, those are two multi-family buildings in New York City. If you look at MF1 and you look at the right-most column there, it says that the delta DSCR, that change in Debt Service Coverage Ratio, was about 0.19 to 0.3, which looks kinda high, actually. But if you look at the second right-most column, its Debt Service Coverage to begin with was very high. So, it was a well-covered property, it was 2.6 to 3.2—remember, again, the threshold is typically about 1.25.

So, yes, even though the energy risk is high relative to Debt Service Coverage, it just wasn't terribly meaningful. And this is something important here, which is that, you need to look at energy risk relative to this—at least in the context of valuation—relative to the base Debt Service Coverage Ratio that you have.

Now, multi-family 2, MF2 over there—different story. It has an energy risk that looks sort of modest. I mean, it's 0.07 to 0.09, but it had a fairly low Debt Service Coverage Ratio that was kind of on the threshold. So, if you had, like, a 0.09, its Debt Service Coverage Ratio with a high tail risk could, in fact, drop to below 1.25.

So, if you go to the next slide—so, what this really points to is that, obviously, in some cases, it can matter, and in other cases, less so, because you just happen to have either a very efficient building or the fact that the building has such high NOI and such good Debt Service Coverage Ratio that even if it were inefficient, it just doesn't matter, from a valuation standpoint.

So, a process that we kind of proposed here is one where, for lenders, is you could pre-screen buildings based on Debt Service Coverage Ratio. If it already is very high, obviously, energy risk is not gonna matter too much. If it's not, then you calculate this delta DSCR that's due to just the energy risk and it's very straightforward based on parameters that they already have combined with this look up table. You could compare that to other practices that you have for other loans that you have in your portfolio, and then you can act on that. If it's a low risk, you can consider a rate discount. Many lenders are trying to be competitive and they want to try and offer discounts—this gives them an actuarial basis to actually offer a discount for efficiency. Or if it's high risk, you could consider a premium or require mitigating measures to help reduce that risk. Next slide, please.

Given the time, I'm gonna skip over this. I'll just quickly mention that there's, one additional metric that we're looking at is a coupon discount. So, just for single family homes, for example, your interest rate is set based on, essentially, your credit score and your loan to value range, or loan to value ratio and then, you know, basically, people will look up what kind of a term you can get for your industry as well. If you go to the next slide, we essentially can develop something similar for commercial building properties with energy risk, where you could look at something like scaled utility cost intensity versus what your current Debt Service Coverage

Ratio is and then offer discounts or premiums based on that. So, that's something we're working on right now with some of these lender partners. Go to the next slide, please.

So, while we continue to work on these, we're currently just starting up a new pilot study that's going to be on a broader portfolio of loans—this initial set was just on about seven loans in terms of the pilot analysis, so this is gonna look at a broader portfolio that really tests the usefulness of these metrics and the ease of application. And again, if anyone's interested in that space, please do reach out to us and we'd be happy to chat on that.

And if I could go to the last slide here, I think what I'm gonna close out with is that there are things we can do now, you know, regardless of when these risk metrics become standard practice in the industry. There are things that lenders and owners can act on now. If you're a lender, you can ask owners to just provide data on the energy cost range. We already know, there's empirical evidence that shows the link to default risk. You can do this as part of property condition assessment, there are ASTM standards for this. One could incorporate energy risk into underwriting and the terms—for instance, offering an interest rate discount for lower risk; Fannie Mae already does this, for example, for multi-family. You could also offer additional loan proceeds for energy and resilience investments. And here again, Fannie Mae has a program to do this as an example in multi-family, and other lenders could do something similar.

If you're an owner and you believe you have an efficient property and you should be getting a break on that, you can ask the lenders to account for that if they're not currently doing that to account for efficiency when they're setting their mortgage terms. And of course, we proactively work with providing data on energy costs and efficiency to the lender, either via the appraisal or the PCA to make that happen.

So, with that, I'll end, and again, I'll just make a note that we have a working group around this topic, and if that's of interest to anyone, please do reach out to us and we'd be happy to chat. So, Joe, I'll turn it back to you.

Joe Indvik:

Fantastic. Thanks, Paul. So, we are gonna get into the Q&A. So, we saw several good questions come in. I'd ask the panelists to go ahead and turn your cameras back on if you'd like.

So, the first question is for Yoon at Four Twenty Seven and the question was, how do you describe uncertainty to your clients? So, the question asker points out that, at the asset level, there's uncertainty around modeling future risks, what those future risks look like, unaccounted for risks like various types of flooding that might not be considered, the timing of those impacts, right? So, given that there's all this sort of forward-looking risk, how do you talk about that and communicate that to clients?

Yoon Kim:

Yeah, the first thing to keep in mind is, our scores focus on exposure. So, we're not necessarily providing an overall sense of vulnerability, but getting—our scores provide a sense of the degree to which we expect a given asset to be subject to a hazard into the future as climate conditions change.

And there are different layers of uncertainty baked into that, and along each step of the way, we try to implement what we can as well as communicate in the best way that we can to help mitigate those and/or make sure our clients fully have an understanding of what those uncertainties are.

And so, as an example, climate models generally speaking tend to perform better or worse for specific hazards and/or for specific regions. And so, we did extensive evaluation of the different models that we ultimately leveraged in order to identify the models that performed the best or the specific hazards that we deemed to be most business relevant. And in parallel, in conjunction with that, we also leverage a suite of models. So, we're currently expanding to a suite of 18 models, and that also helps us to reduce the uncertainty that's baked into those models by some degree by being able to leverage a broad spectrum of them.

And then, as far as the communication of some of the uncertainties associated with the data, we are as transparent as we can be about what our indicators include and what they do not. And so, for instance, when it comes to our flood risk data, our metrics include regional mitigation measures like levees, and we make sure to communicate things like that to our clients so that they have an understanding of what's included.

And the final thing that I'll note is that the data that we provide is not meant to provide a definitive view on an asset's exposure, because it does—or an ethical vulnerability, because it does focus on the exposure piece primarily. And so, it's an important starting point which then, additional analyses are often very helpful to understand asset specific risks, for instance.

And so, if you know, let's say you're conducting a portfolio evaluation based on our data, you can identify the assets that emerge in vulnerable hot spots or floods, sea level rise, or other hazards. And then based on that, that gives you information or it can point to assets that warrant paying closer attention to, and then you can dig in deeper and gather more asset specific data related to flood mitigation measures or other design and engineering features that influence both risk and resilience at the asset level.

Joe Indvik:

Got it. Okay, great. Thank you, Yoon. There are two more quick questions, here, for Ben and Paul. So, to Ben, one person asked if you're seeing insurers entirely pulling out of markets where the risk is high or expected to become high. They mentioned that there's already some coastal communities where private insurance is not available. Are you expecting that? Can you talk more about that, and are you expecting that trend to continue?

Ben Harper:

Yeah, you know, I think you'll see more of the smaller regional specialty companies probably paring back where they can. It's a delicate balance, because there's certain areas that, really, the loss experience isn't great for us, but we also recognize that there's other products and services in those communities that we're also providing. So, in addition to just pure physical risk coverage, we may be providing other business transactions as well. So, it's important for us to keep some continuity in the community.

But absolutely, as I said earlier, ultimately, there are some risks that just become uninsurable, or the pricing becomes so extreme, it's just not attractive or doesn't make financial sense for someone to own that asset.

But I think you're gonna see a greater trend towards a really big push in the resilience space. At the end of the day, we all want to continue conducting business in these areas, and resilience and mitigation are some ways that we can continue to do that. So, while yeah, you might continue to see some people pull out of certain markets in certain areas, I do think you're gonna see, really, an enhanced effort in the resilience as well.

Joe Indvik:

Great, thank you. And Paul, there were a bunch of wonky modeling questions in here, so I'm gonna try go aggregate a few of them together into one that I'm particularly interested in, which is, one might imagine that energy use intensity and other operating costs are pretty heavily correlated for a building—so, a building

that spends more on energy might also be operating inefficiently in other ways, janitorial or what have you.

So, I guess to kinda distill that down, might there be a bit of an omitted variables bias question here, in that buildings that have better EUIs also have other things going on that make them less likely to default on the mortgages, and that's, in fact, the effect that you're seeing? Could you talk more about whether that's true or not?

Paul Mathew:

Yes. Correlation, as anyone who's taken 8th grade statistics knows, correlation is not causation, and we don't know whether these are causal, obviously. The point is that it's strongly correlated, and from a lender perspective, again, it's—it just means, even if it's a proxy, it means it's a signal that they can look at and it's an indicator that things could be better managed from that perspective.

So, it can still provide that signal into the market. And again, let's not forget, though, that it's not sort of an exotic proxy, as it were. There's an actual, real connection here between energy costs and NOI. Lower energy cost—again, all other things being equal—does equal higher NOI. So, it directly translates into value. That kind of goes without saying. It's just that from the empirical analysis itself, we cannot definitively see that it's causality, it could just be overall things are managed better—yes, that is certainly true.

Joe Indvik:

Got it, got it. Okay, interesting. I wish we had time for more questions, but we do need to wrap this up, so, I'm gonna do just a quick couple of final slides, here, but thank you, all, for the Q&A.

So, we compiled some additional resources relevant to all the speakers here today as well as some general Department of Energy resources, so you can check those out, most of them on the Better Buildings Solution Center or other links which are available here and will be in the deck when we send out the recording of the webinar. I also want to highlight that the next Better Buildings, Better Plants Summit is gonna take place on May 17th through the 20th. This is gonna be a virtual, no cost event featuring engaging, always very interactive sessions, as well as opportunities to network with fellow attendees and peers and experts. So, registration is gonna be coming soon, but visit the Better Buildings Solution Center to learn more.

And then, as I mentioned before this webinar—if you go to the next slide—this webinar is part of the 2020 to 2021 webinar series. There's a bunch of other webinars that have been one and are upcoming. We've got a great line-up here, so you can visit the Better Buildings Solution Center to watch any other recordings or join future webinars.

And speaking of upcoming webinars, I want to highlight the next one coming up on March 2nd, which is entitled "Smart Tools for Smart Labs." This is gonna share some helpful, publicly accessible tools for putting together a team, assessing laboratory functions, and then optimizing operations and laboratories, and we can also, it'll be an opportunity to kind of learn from Better Buildings Smart Labs partners' experiences and dig in a little bit to what's next for laboratory energy efficiency.

On the next slide, we also encourage you to visit the new workforce development portal. So, this is an opportunity to take the next step if you're looking to build a career in energy efficiency or get resources, information, training, education, job opportunities, it's all available here.

On the next slide, I want to note that on demand Better Buildings webinars are available. These are from the virtual summit, the 2020 webinar series, or other technical presentations that have been done at the national labs, so you can visit the on demand webinars library where all of those are recorded and available.

And if you go to the final slide, I just want to close by thanking our panelists once again for being a part of this. It was a really good conversation. I'm sure they'd be happy if you want to reach out to them directly at the e-mails here. You're also welcome to reach out to me—again, this is Joe Indvik, here, and if you have any questions about the DOE resources or any of the work that we're doing in this area.

And finally, I encourage you to follow Better Buildings on Twitter if you're not already, and then we'll just let you know that you're gonna be receiving an e-mail notice that the webinar recording is available in about a week.

So, with that, I think we can wrap up. Thanks, everybody.

Ben Harper: Thank you.

Joe Indvik: Take care.

Yoon Kim: Thank you.

[End of Audio]