[SQUEAKING]

[RUSTLING]

[CLICKING]

ZEYNEB MAGAVI: Our next speaker is Tito-- sorry, Christoph Reinhart. And I'm going to, again, let you introduce yourself.

CHRISTOPH REINHART: OK. I think--

ZEYNEB MAGAVI: You've got it. You're all set.

CHRISTOPH REINHART: Thanks a lot, Zeyneb. Good morning, everybody. Great pleasure to be here. Thanks a lot to all of you for taking the time to learn about this important topic. And as Zeyneb said, we all have to get involved in this and become active.

I didn't learn how to use a caulk gun from Zeyneb. I learned that from my father-in-law, with whom I've done a lot of building renovations over the years. But I'm meeting Zeyneb regularly over the past year on pi days and other events to eat a lot of pie. So I think you only know me with a serious sugar rush.

[LAUGHTER]

So let's see where I have my remote control here. Yeah, I think that fits really well. Basically, Jay talked about the whole planet and the effects of various actions on the planet. And I try to make the jump from the planet to the individual building and what this means for an individual building owner.

So I'm really excited about the slides, since last week a little less so. But what we put together basically that as of April of last year, we had a spectacular 148 countries that represent 90% of the world's population and 90% of the world's GDP that had jointly said it's a good idea to decarbonize our industry, our world. And if we think about in what kind of incredibly polarized times we live-- and I guess last week shows that there are some bumps in the road towards this joint goal-- but that there is an incredible buy-in here towards this idea of having a net zero global economy.

And I would call this goal really, really radical. And the reason why is because it's so different from what we have been doing. And not a lot of people know this. I only came across that a couple of years ago. It's really worthwhile looking this up. This 1952 "Paley Commission Resources for Freedom." That was a report that I would say was really the moment that defined global attitude towards economic growth, fossil fuels, and so forth. This was done by a set of experts, was really widely published. The Paley Commission was headed by the president of the CBC, Paley. And basically, the sentence at the bottom is really key. It says that "permanent economic growth, powered by cheap fossil fuels of arbitrary origin, is the overarching political priority of the 20th century."

And if you think about it, it's hard to think of any policy that has been implemented with more vigor over such a long period of time. And so that in the face of this we want to change here is really remarkable. Of course, we really don't want to get rid of our energy use. We want to get rid of the related carbon that's related to the energy. But it's a big change. What are the drivers between these changes? Well, in a way we heard about it already. There are lots of disasters happening worldwide. There's just political momentum building, and organizations such as HEET obviously provide solutions towards this global initiative to say we want to basically change the ways we deal with our planet.

I would say, a key driver is also that cities, a lot of cities are located near the sea. And due to sea level rise, we see cities becoming so much under pressure that they're disappearing. I'm not sure if you followed that Jakarta is the first mega city who announced that they're going to move Jakarta. There won't be any Jakarta anymore. The reason is sea level rise, overuse of groundwater in the city. So there are some dramatic photos out there that I didn't want to share due to our OpenCourseWare friends. I'm not even sure if I'm allowed to show this graph here from *The New York Times.* But it's very dramatic what is going on there.

And then finally, of course, we hear that all the time more and more extreme weather events are happening. This graph we put together a couple of months ago that basically looks at NOAA's recorded extreme weather events-- well-- over the last 70 years. And 90% of these events have happened in the last decade. So it's really dramatic what is happening. And I'm told I have to speed up.

So now I try to make this jump. How do we get basically from our goal of-- these are of reducing the temperature, keeping global temperature rise, let's say, under 2 degrees C, whatever our goal is? Then we know we have 930 gigatons of CO2 left to make the global building stock-- or the global economy carbon neutral, really. If we are releasing more carbon in the atmosphere, it's going to get warmer. So if we now say, OK. The building stock can take 40% of this, then an easy number to remember is that we have 340 gigatons and 30 years left to make the global building stock carbon neutral.

Now, this is our budget. Where can we spend our budget on? It's basically the projections are that the global build area is going to double by 2050. So this is our budget, and this is where we have to spend it on. This is a simple graph that shows three predictions of what we could do to the global building stock. Business as usual says 1% renovation rate globally. This is what we currently have. And by 2050 we will have net zero solutions for all buildings, new and renovated. That is going to blow our budget dramatically.

Then the top of the orange line shows what happens if we have, in 10 years, net zero new buildings for all new construction, and we increase the retrofitting rate to 5% per year. That still doesn't get us fully there. We also need to have, by this point, embodied net zero. So all the energy that goes into building the buildings, we somewhat have to have net zero technologies. We have zero ideas of how to do that right now.

But if we are putting that together, really, I would say there's a three-pronged approach of how we are going to move the building stock around. One is, again, 5% renovation rate per year. Within 10 years, we need to have carbon-neutral solutions for all new construction and for building retrofits. And really, I would really question this terrible notion that we have to double the build area. Like in 5-- in 30 years, we're going to build what we have built in the last 5,000 years seems a terrible idea. So more efficient space use is very important as well.

So since I have only two years, I'm now trying to take it down right to the individual owner. So if you have a typical building in New England right now in Massachusetts, the main proposal that you get is put PV on your rooftop and put in an air source heat pump. That's really what Massachusetts is pushing. And so if we look at what that means it's basically if you just in isolation put in a heat pump that in the best case scenario, unless you do it yourself, costs you about $25,000. And that's important if you're using natural gas right now, increase your operating costs. So really, from an economic standpoint, the best you can do is put a heat pump, use an air-source heat pump and a PV system.

But what that happens-- if you are doing that, then of course, very suddenly you have a building that puts a really strong strain on the grid because you're creating the electricity in the summer, but you're having a new peak due to your heat pump in the winter. And so we don't have any big battery lying around somewhere. So that is a key problem overall.

And so what we should really do, and I know I'm really there, is we have to have a detailed-- we have to offer every homeowner a whole series of different choices that they can make with LEDs, better appliances, retrofit their building, PV, putting in a heat pump. This type of analysis we want to give to every homeowner. And in order to reach this goal, we're working with the state of Massachusetts right now.

We build a model, a 2.5 million buildings. And the way this is going to look like, in a few weeks, you can go to your building. You can set what have I done to my building right now? And then we're going to give you estimates in terms of cost, carbon savings, and so forth, what you can do. Right now, in the first instances we probably have air-source and ground-source heat pumps, not a network. But these are things that we can introduce over time if there's interest. Thank you.

[APPLAUSE]