

[MUSIC PLAYING]

OK, good afternoon. I hope everyone had a good lunch. My name is Laura Moon. And welcome to the Adaptation for Extreme Climate Events breakout session. In this breakout session, we are going to be asking you, the audience, questions throughout the session. And we're going to be using a software called Slido to capture those to participate, please scan. This QR code is also in the booklet on the second page just on the other side of the table of contents as well.

If you are here in the building, it's best if you join the Hilton local Wi-Fi for best performance. And if you're unable to scan the QR code, you can just go ahead and enter the Slido URL here. All right. And once you're in, just please identify your industry affiliation. And you'll be ready to participate.

And so for each question, you're going to have three minutes to answer that question. And at the end of the session, we're going to come back and share key results with everybody in the room. And with that, I'd like to welcome our presenter today, Nathan Bengtsson, who will run today's session.

Excellent. Good afternoon, everyone. Thank you so much for being in the room. My name is Nathan Bengtsson, and I have the pleasure of leading PG&E's Enterprise Climate Resilience team. And I'm really excited that you all are in the room here today because we need your help.

We need your help to get ahead of climate-driven physical risk, not just at we have something getting hit by a tree perspective, but at the overall enterprise perspective. How do we value resilience? How do we make it real in investment planning? How do we start planning for the future today in a way that preserves value and affordability? So that's what we're going to talk about.

So I think it's important when talking about resilience-- climate resilience, in particular-- to set a baseline of what we mean. And so really what we mean when we talk about resilience at PG&E is that we're able to deliver for our hometowns, which is our language for doing what we do, deliver for our hometowns in the face of more frequent and extreme climate-driven natural hazards.

On the left side of the screen, you'll see some statements that talk about what delivering for our hometowns means. And hopefully, for people in the energy and utility space, they're very, very familiar. It's about reliable energy service. It's about quickly restorable, safely restorable energy service. And it has to all be affordable. And that's what it will mean for us to deliver in the face of climate change.

I think what I want to highlight here is that our mission is not changing. We are here to deliver safe, clean, affordable, reliable energy to the people of California. What is changing are our operating conditions. And that requires a change from us and how we plan and run the system if we're going to succeed.

So I want to zoom out just a little bit and let where we are on our journey and where we're going. And there's some parity between this arc and the three questions that I'm going to pose to you all today that we'll get to in a slide or two. And so we have been on this journey for some time. And I want to also point out that wildfire is its own consideration.

So we're in charge of the enterprise risk approach to climate resilience. We know that wildfire is an existential threat. And we know that we need to handle that. And we've been doing that for years now. But we also need to extend that to our other risks-- extreme heat, rise in average heat, precipitation changes, things like subsidence, water availability. These are all changes that are coming that we need to plan for.

And where we are in our cycle is we've really acknowledged our risk. We filed our first climate adaptation vulnerability assessment in May of this year. And we'll talk about that at the end of this presentation. And we understand, at a high level, which of our asset families are going to be in trouble and where we need to focus.

But we need to take it to the next level, and we need to go faster. So we need to go from being climate-aware to climate-informed, and eventually, climate-resilient. That means that climate data is available and it's used in our risk assessment and planning. And then it's just part of doing business.

We're thinking about this when we're making our investment decisions. And we're saving money in the long run by making the right decisions today. And ultimately, this gets down to being able to measure the benefit that we're getting for the dollars we're spending on this relative to climate hazards, which is really hard because climate hazards materialize in uncertain ways.

So it's a little bit of a moving target. But we think that with your help, we can get much closer to understanding what good is for climate resilience and making progress toward that. So let me just bottom line the stakes here. So our company is set to spend billions of dollars in capital investment over the next 10 years, a timeline which corresponds with what we know are projected to be major changes in our operating environment.

And in order to preserve the performance and affordability of our system, we have to make the right investment choices today to get there. And so there's three areas that I would like your help with today. The first is asset-relevant climate hazard projection data at the narrowest level, and then zooming up one level, climate hazard informed risk assessment and asset management, and then finally, that overall planning view.

How do we measure risk? How do we measure the value of risk buy-down? How do we know when the right thing to do is to move a substation because of sea level rise versus doing, I don't know, 100 more units of tree trimming this year? Those are the questions we're asking ourselves at the business and that we need your help answering.

And so with that, we'll dive in. So the first topic is the narrowest one. It's specifically about asset-relevant climate hazard projection data. So if any of you are familiar with Cal-Adapt, that is the state's tool for providing climate data to the energy and utilities to plan better.

And while some of these climate hazards are really well built out, we have strong projections, relevant metrics, there are others that are highly relevant to the system for which we don't have actionable data yet. And so the question becomes-- we have all this observed data from the 20th century. We have climate projection models. They're increasingly sophisticated.

So how can we start to employ the technologies of the future, AI in particular, in order to get to answers on some of those highly relevant hazards, particularly lightning and high wind? Those are two that we know. We've heard from our standards people, from our engineers, they're worried about this. And we need to understand better how they're happening.

Now, it's hard because they're highly synoptic events. You can't predict where lightning is going to strike, but hopefully, together, we can figure out a way to understand the patterns of how lightning behavior will change in a way that allows us to plan better. So with that, we come to our first question for you all.

How might climate projections for hazards relevant to energy assets, such as lightning and high wind, be improved to enable resilience planning? And again, the role of AI and machine learning is particularly interesting here. So if you can't scan your QR code, you can go to the URL, [app.sli.do](https://app.sli.do) and [pge24](https://pge24.com). And you have three minutes to input some answers to this question.

[MUSIC PLAYING]

Have about one minute left to finish inputting your thoughts.

[MUSIC PLAYING]

All right. Thank you for your input. And I should say that it's not just being absorbed into the ether. At the end of this conversation, we'll have an opportunity to take a look at some of what you all provided and sort through it a little bit. So you won't be graded, but there will be feedback about what you actually were able to provide. And we'll talk about it a little bit.

So moving on at a breakneck pace to the next topic, which, again, is one step out of the funnel here, we're moving from climate projections themselves to really where the questions start to get answered, which is how do these projections, when they materialize, expected to interact with the assets that you have on the system?

This is really complicated, especially for a very large utility, like PG&E. We have multiple climate hazards, each with uncertainty related to the projections associated with that hazard. We also have different relationships between how an asset is sensitive to a hazard.

Sometimes, it matters that it's going to rain a lot for a piece of equipment. Sometimes, it doesn't. And we need to understand that as well. There's the characteristics of the asset itself. So it's not enough to know that you have a certain kind of transformer and that it's sensitive to, say, high heat.

You have to also understand that it's been overloaded. It's been on the system for a long time. It's more likely to break than another one of the same type. And you have to take that into account as you're starting to design interventions. And then you also, ideally, would have the ability to aggregate and disaggregate climate-driven risk from other factors.

So I think people often talk about what's resilience, what's reliability, where do they meet. And I think there's lots of answers to that question, but I think what's particularly tricky is knowing when an investment is incremental that you would not have otherwise made, or when you're making a reliability investment that actually does have some long-term resilience benefit.

And so building in the ability to say, OK, this is a resilience investment for a climate reason for long-term projections versus this is something where we're going to make the grid a little bit stronger, but maybe it hasn't been intentionally done in the face of climate projections-- that's really important. It's important because one, we should know what we're doing.

But two, we need to be able to explain to our customers and the regulator why we've made a particular choice. And so having transparency and just clarity around that is going to be critical. So I think we've gone a little faster than I intended, but that's OK. That'll just give you a little bit of extra time to think about this question. Here it is.

In your experience, what ideas or solutions might provide a better understanding of asset-level climate risk in a way that is manageable across hundreds of thousands of assets? And again, AI and machine learning are the frame for the answers that we're thinking about today. With that, we'll go ahead and take three minutes to think about it. Thank you. Cue the music.

[MUSIC PLAYING]

And if you're just joining, don't be shy. Please whip out your phone. Take a look at the question. And if you have thoughts, please, we'd love to have them.

[MUSIC PLAYING]

About 30 seconds remaining. Oh, one minute remaining. You have a little more time.

[MUSIC PLAYING]

All right, I have been given the signal that we can move on. So that brings us to our third topic and, I would say, the top of the funnel, the biggest problem that we need to think about, or the biggest context in which we need to think about this problem. So we talked about asset-relevant and climate hazard projection data, just having a good expectation of what's to come.

We've talked about how to apply that to our existing asset base in ways that provide us actionable insights. There's also the reality that climate resilience or adapting to climate change is by far not the only problem that utilities are investing for. We have load growth. We have standard asset health and maintenance considerations.

This is a problem on top of, or a multiplier of, the existing things we manage the system for. And so I think the most high-level, mature version of this is one where we can value our climate resilience investments relative to other pressing investment considerations. And affordability is obviously a huge consideration here.

Our customers-- and no one, really-- can afford to future-proof the grid. And so we need to get good at deciding when something is worthwhile and when we can afford to rebuild it after the storm. I think a really good example here are substations. So you have a bunch of electric substations around the San Francisco Bay, for example. This is a highly dense area.

There is not a lot of greenfield or brownfield where we could build another substation or move a substation, which would also be extremely expensive. And it would potentially disrupt service to our economic urban cores. And so the question becomes, do you build a seawall to protect in place? Do you move the substation? Do you do either of those things in this year, in 5 years, in 10 years?

Sea level rise is a long-term problem, but combined with something like storm surge, you could have nuisance flooding next year. And so the question becomes not only timing, but the relative value of your intervention when you also have lots and lots of trees that need to be trimmed right now.

So how do we make climate resilience investments today, investments that need to be made for a longer-term problem, show up in the investment planning process in a way that allows us to actually understand their value and communicate that value to customers and to our regulator? And so that's really the last question that we want to ask you all about.

The question, in this case, is, how should PG&E assess the value of investments to mitigate the impact of climate hazards relative to other investment priorities, especially given the inherent uncertainty of climate projections and the extended lead times of some climate hazards, like sea level rise, as we talked about in the example. How can we make good decisions about this based on the information available? Cue the music.

[MUSIC PLAYING]

About a minute to go here, and then we have a bonus question after this one. So don't put your phones away.

[MUSIC PLAYING]

I'm going to flip to the bonus question. We have about 30 seconds left, but we'd also be delighted if you would be willing to provide the name of your company or organization. So optional, but we'd love to know who we're talking to and who's talking to us. Just take another 15 seconds.

All right. So there is a reward, if you can call it that, for having sat through and answered the questions. I mentioned at the beginning of this, that PG&E submitted its first climate adaptation and vulnerability assessment in May of this year. And what we're looking at here is the highest level sublimation of what is, I think, an 800-page report. So there's lots there, in case you want to learn more.

[Pge.com/climateresilience](http://Pge.com/climateresilience)-- you can find the full report as well as the full supporting executive materials. But after asking you the questions, it seemed only fair to share some of the insights that we got from the assessment. So that's what we're going to do now.

Fundamentally, I think the main takeaway, as you might expect, is that more frequent and extreme physical climate-driven hazards are going to make it difficult for us to achieve our goals on behalf of customers if we don't take action. And some of the things we found were-- you can see the summary relating back to the color chart of the different levels of climate hazard that we characterized across our asset families.

So for the electric asset family, we found that higher temperatures, higher load-- that's associated with AC use as well-- could result in insufficient capacity, reduced equipment life, and reliability issues on an already aging system. And so from there you can start to build your strategy for going forward. And I hope you can see how some of the recommendations here relate to the questions that we asked you about how to do that well.

We're also seeing some concern around flooding in excess of planning and operational assumptions. If anyone remembers the atmospheric river events of the winter before this, that was abnormal, but it may be increasingly normal. And so we need to make sure that stuff that delivers electricity and gas that shouldn't get wet doesn't get wet.

And then, of course, the risk of wildfire from any source is projected to increase, causing direct damage to equipment and ground conditions. And something I want to be really clear about is that the climate adaptation vulnerability assessment is a complement to but separate from PG&E's wildfire mitigation plan.

So for this we looked at how fire behavior might change in ways that could impact our equipment, whereas the WMP is about-- how do we make sure that our equipment does not generate an ignition that could lead to a fire. In both cases, climate change is causing the fire risk to be very high. It's just the direction of the impact, if that makes sense.

So I think overall, what I would say about this chart is that there's work to do. We have more to do to make sure we understand our vulnerability, to make sure that we have a set of tools that we can employ to act on that information so that we can take the action we need to today to build the grid of the future, just as par for the course, as part of doing business to preserve affordability and reliability for the long term.

I'd like to end at least my portion by saying, by 2030, we're on track for 1.5 to 2 degrees C of global warming. Many of you are probably aware that 2 degrees C is the very worst outcome that the UN has thought about in the past. That's only six years from now.

So as much as the impacts may not come till later, when you're putting assets in the ground that cost this much and that last for 40, 50, 100 years, you have to make the right choice today to preserve that affordability and reliability. Exciting. With that, I welcome Laura Moon back to the stage so we can start to talk about some of the input you all provided.

Great. Thank you. OK, let's flip over to Slido, if we can. So thank you, everybody, for-- did you have one more question?

Yes, I do have one more question. I'm so sorry. We've got to switch back to the PowerPoint. Thank you. I was just so excited to look at your answers, y'all. I'm sorry. [CHUCKLES]

While they're doing that, we can look at them.

Yeah, perfect. So this is the last problem. And if I just gave a stirring speech about climate, this is the opposite of that. It's a very practical consideration, which is how can we, as PG&E, make it easier for you to create solutions, hardware and software solutions, that are interoperable and integrate with our existing systems?

I'm sure many of you have experienced the problem of data sharing in the past. We have a lot of data. We need to combine it with other data. And it can be difficult to do that kind of handoff. And so any feelings you have about how to make that easier for us to partner, we would find really valuable. So take a few minutes and provide your input. Thank you.

[MUSIC PLAYING]

[SIDE CONVERSATION]

All right. About 30 seconds left to finish giving your input on this question. And then we'll turn to your answers.

All right.

OK, we can move over to Slido now. So again, thank you, everybody here in the room, as well as those online, for participating. Very, very valuable. So let's turn to your common responses for how might climate projections for hazards be improved to enable resilience planning.

So the most common answers for this were around remote sensing data, satellite imagery using IoT sensors, geospatial mapping. Anything that's standing out to you there?

Yeah, so I'll be very upfront and admit that I have pretty strong feelings about my answers to these questions. And so I was really excited to see what you all thought-- whether I'm right or I'm wrong. I'm joking, but seriously, I think something this reinforces for me is that PG&E is blessed to have a pretty strong meteorology team.

And there's real opportunity there to combine the forward-looking projections that I deal in and the real-world observed data that they have been collecting at a-- that capability has been getting more sophisticated over the last five years. They process terabytes of data.

So I can see absolutely taking some of these suggestions and continuing to build that bridge with them to make sure that we're making the most of the data that we're already collecting. Absolutely.

Great. I think that there's a number of the partners here, actually, that are bringing a number of these technologies--

Also that.

--partnering with you already. OK, great. Well, let's go ahead and look at the surprising answers to that same question. So we have answers around leveraging tribal and Indigenous knowledge of local climate patterns and ecosystems, crowdsourcing via mobile apps and portals, as well as partnering with insurance companies to share climate risk assessments, and then also, integrating data from smart meters.

I am excited by these answers because we always say that resilience is a shared goal. And I think it's true that solving these problems is going to require more coordination across sectors than we've had in the past because these are ecological-scale impacts. Someone doesn't just own the shoreline, and then the problem is over. We all share that shoreline. And then there's the stuff behind it.

And so the idea of looking to not only the people who have been here stewarding the land for a very long time, but also the idea of looking to our customers and to insurance companies, people who think about this a lot, is a great idea. And I think ideas that we've had-- but it's really nice to have the additional oomph to pursue them.

Wonderful. Thank you. So the second question, which is what ideas or solutions might better be able to provide a better understanding of asset-level climate risks across the hundreds of thousands of assets-- so here we have answers that are more common around remote sensing data and satellite imagery, as well as IoT sensors, and then applying AI and machine learning to analyze massive data sets that probably also come from those sensors as well, and then paired that with geospatial data integration.

Yeah, I think these are great ideas. And I would be interested to talk to folks who have more detail to share about how best, actually, to do these things. I think on a conceptual level, yes, absolutely. And then actually getting to those massive data sets and using them and getting predictive failure and all that kind of thing is complicated. So if you're the people who had input on this, please come find me. I'd love to talk to you more.

OK, great. And then moving on to the surprising responses from that same question, similar to the one before around crowdsourcing, we've got leveraging social media data to identify unreported outages and infrastructure issues, gamification platforms, which can incentivize communities to report hazardous vegetation conditions, as well as crowd-sourced weather impact data from field workers using mobile apps, and cross-referencing historical cultural data. Anything that you guys have already spoken about or looked into?

I think this is another great example of the need to share information, to collaborate across sectors and in nontraditional ways. I think that this last one is the most interesting to me of this slide because they're talking about cultural data. But I think, as I was saying, resilience is a shared goal. And there's usually multiple actors impacted by a climate hazard.

And so the idea that we need to overlay our vulnerabilities and maybe find mutually beneficial solutions that can maybe lead to, say, something like a federal grant, is really, really smart. Appreciate that.

Great. And then our third question, which is about the investment-- so where should you put your investment dollars when there are so many different things to focus on? So the most common responses here were either the high probability catastrophic risk first, but then compare that with the lower one, which is the let's go after the low-hanging fruit projects. How do you think about those two?

Yeah, I think we're seeing where the technical side of this, using the climate projections and combining it with asset data, meets the business strategy side of this. And I think we need that technical solution set to help us decide between option A and option D on this list. So I appreciate that there are both offered because part of this game, I think, is deciding on a strategy based on the information that you have.

Great. And then on the third one, also considering the equity impacts and environmental justice weighing the community vulnerabilities--

Absolutely. So the CAVA that I shared results from had a very prominent community engagement element because ultimately, we're doing this adaptation on behalf of customers. And we want to understand how their energy-related needs are changing. So thank you for calling that out. That's a major consideration.

Great. And then the surprising answers on this one-- I think the first one is really interesting. Design infrastructure to deliberately fail gracefully rather than catastrophically under stress. How do you fail gracefully?

I'm imagining a pole fainting, just falling over ever so lightly. But no, this is a really important question or point about the trade-offs between hardening versus restoring. We have planning functions, and we have operational functions. And they are both tools in this affordability performance game. And so being able to understand which is the right one for a given hazard is really important. And we need to do that.

Yeah. You've got a tough job ahead of you to do that. I also think that the last one is also really interesting to me-- integrating nature-based solutions, like living shorelines that can grow stronger over time.

Yeah, I think there can be a tendency for very engineering-heavy organizations to discount ideas like this. It's like, well, how do you measure the benefit? And that's the Caltranses of the world. They like to build very directly. What I will say is I think this is an opportunity that comes from the shared nature of the problem, where if we're going to build a seawall to protect a substation, we're probably doing that in partnership with other people along the Bayshore.

And the people who live there probably have an opinion about what that looks like and how they can use it. And so that's one where I think the communities we're partnering with to build resilience over time can push us to be better and a little more imaginative about what the solutions might look like.

This actually happened. There's a great example from the San Francisco or from the San Mateo Peninsula. We partnered with a local jurisdiction that was doing shoreline protection. And they brought the project to us. And so going to be this beautiful ecotone levy that's going to preserve the aesthetics of the environment. And it's also going to provide protection to a substation that feeds all of the peninsula and San Francisco. So that seems like a win-win-win to me.

Definitely. Wonderful. Well, thank you so much again for participating. All of your sessions today will have some participation in them. And with that, I'll turn it back over to you, Nathan, to do some closing remarks.

Yeah. I'll start by saying thank you. This is not a problem where all the answers are available and able to slot in. This is a problem where it requires creativity. It requires coordination across expertise. And so I'm deeply gratified that you chose to be in this room and pick up your phone and actually say something. So I really appreciate that.

And I think other than that, please keep this problem in mind as you go about your lives. Maybe you are more or less related directly every day, but part of what we're doing here is changing the culture of the energy sector to plan for this specifically. And so the more you talk about it, the more you think about it, the more it permeates what we're doing here, and the closer we get to a solution. So thank you. That's it.

[APPLAUSE]

[MUSIC PLAYING]