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[INDISTINCT CHATTER]

All right. Good afternoon, everybody. Welcome. Welcome to the Intelligent Systems Planning and Interconnection Breakout Session. In this breakout session, we'll be asking you the audience questions throughout the presentation. If you are in one of the former ones, it's the same focus here.

We're going to be using Slido to capture your answers. In order to get Slido to participate, you can scan this QR code here. It is also on the back in your program, right behind the first page. If you're here at the Hilton, please do join the local Wi-Fi for best connection performance. And at home, obviously, you can join at home.

Once you get in, please identify your industry affiliation, and you'll be ready to participate. This help us segment the answers by who you are. For each question, you're going to have 3 minutes to type in your answer. And at the end of the session, I'll be coming back up and we'll be sharing the highlights from those questions with all of you and asking our presenters to comment on those. So with that, please welcome Satvir Nagra, Ashwini Mani, and Brad Detjen, who are going to be running today's session.

[APPLAUSE]

Hi, good afternoon. And welcome to the Intelligent System Planning and Interconnection Session. I hope you guys have had a good morning. As you heard in the big room this morning, a lot of the things that were discussed there, it all comes together in what we're going to discuss here today.

I'm Satvir Nagra. I'm the Senior Director of Electric System Planning and Interconnection here at PG&E. And I have teams that cover transmission and distribution planning, as well as generation interconnection.

And with me today I have Ashwini Mani, who is the Manager in Transmission Planning. And she leads a team that does all our load and generating connections. And she also leads the first ever effort to do a cluster study for load that we just did in our San Jose area.

Also with me today, I have Brad Detjen. And he's a Manager in our Distribution Planning Group. And he leads the team on our Distribution Planning Tools and Area Planning. And we're going to get this session started with Brad talking about the first topic. Thanks.

Thanks, Satvir. So as you've been hearing throughout the day today, our transmission and distribution system is facing greater capacity challenges than ever before, with increasing rate of load applications, data centers, EV electrification, building electrification. And as always, this ramps up. It puts more and more demand on our planning tools and processes to be as efficient as possible to allow us to connect our customers quickly and at the least cost to ratepayers and to the customers.

Furthermore, as we look at uncertainty in the future, whether that's policy uncertainty or climate uncertainty, we have a greater and greater need to study many different scenarios in our tools. And we need to study them in greater temporal resolution, more hours of the year, so that we can identify those periods of time when the grid can accommodate loads with minimal capacity upgrades. All of this means running more studies more efficiently.

And we've been working with our vendor partners to develop automation tools in our planning processes. And we have some industry leading tools. But the first topic we'll be covering is that the data models inherent to these tools need to be well aligned with the customer applications that come in that we then use to process our studies. And so I'll talk a little bit about load applications and then hand off to Ashwini to talk a little bit about generator applications in this way.

So starting with load applications, historically, the paradigm for an incoming load application has been that it is essentially a list of connected loads. It's similar to sizing a breaker panel. You have a list of HVAC and lighting and whatever loads may be there at the facility. And then a service panel would be sized to accommodate all of them as though they were operating simultaneously.

But that doesn't account for the diversity of those loads and their operating profiles. And that diversity increases as you move further upstream in the distribution system and the transmission system. So we, of course, in order to study the most cost effective ways to serve these new loads, we've moved toward modeling every hour of the year in our planning tools, which, of course, increases the amount of studies that we have to do, but allows us to identify those periods of time when the new incoming load may not actually trigger a capacity issue because it doesn't overlap or coincide with the feeder level load peak. And so we have now in our planning tools, we've moved toward being able to model every hour of the year, we are doing time series modeling, but we need the incoming load applications to have that same degree of temporal resolution.

What we don't have for customers yet is a tool that allows them, at the time of application, to create that shape and edit that shape according to their planned operational needs. So currently, we assign them a shape based on the industry that they may be in. But that may not account for all of the complexities of the customer's plans.

Furthermore, as Patty alluded to in her session this morning, we have the ability to accommodate flexible loads. And they can adapt their profiles to match the capacity constraints hourly on the circuit. But the paradigm today that is reactive. We provide that option to customers after our studies show that they've triggered a capacity constraint. And so we want to envision a tool that would allow customers, as they apply, to have visibility of our capacity level constraints on an hourly basis and be directed to those load flexibility opportunities.

So that is question 1 for everybody. What tools and technologies are available that build an accurate hourly shape for a commercial or industrial customer who is applying for service and provides options for adding load flexibility?

[MUSIC PLAYING]

All right, hi, everyone. Good afternoon. I think we've all had a wonderful time this morning learning so much in the morning sessions. Let's talk about generation. Brad did a great job about load applications. I'm going to talk a little bit about the generation interconnection applications we receive.

So PG&E is committed to meet the state of California's goals of 100% clean electricity by 2045. What does this mean? We have to integrate a large amount of renewable generation in our systems. This is solar, wind, energy storage, and other renewable resources.

In PG&E's service area, we are currently studying 197 applications totaling 44 gigawatts of generation that's coming in through the California ISO's generation interconnection process. This is a lot of applications that comes through the intake process that needs to be validated by utility engineers, the California ISO engineers, and the interconnection customers themselves before it's deemed valid to actually be part of the study.

So the first step of the interconnection process is we get these applications, customer sends project-specific data that is submitted via Word documents, Excel spreadsheets. They also submit their detailed models that is provided through power flow and dynamic models. All of this data goes through a very lengthy iterative.

And under short durations, needs to address data entry errors, those are manual errors someone-- two documents, two wrong data points, someone needs to manually check that and fix it. Validation of IBR models, Inverter-Based Resources. We're connecting renewables. We get a lot of IBR models. We need to validate these models to meet industry standards. We need to tune the IBRs so that when we actually study this in a power flow study, we're not really fixing errors because of bad data.

This is an actual example of back and forth. This customer went through nine rounds of iterative back and forth validation over eight months before their model was validated and before the study could even start. And a lot of the errors can be fixed. So-- oh, sorry, my bad.

OK, testing, tuning, and validating IBR models submitted during the intake process often is a frustrating and overwhelming experience, both for the utility engineers and the interconnection customers. IBR models, why is it important to have these models validated? It needs to ensure that there is alignment between their power flow models and their dynamic performance of their inverters. This is important because the grid needs to maintain reliability under various operating conditions when these generators are connected to the grid.

The IBR models that is submitted through the application package needs to adhere to NERC and FERC standards for reliability. These are standardized requirements that is already in manuals and guidance documents that is posted by industry standards. That data is there for inverter-based resources.

IC's need to val-- what do the interconnection customers need. They need a validation platform where their models are validated, they conform to industry standards, it can be stored, there is an option for real-time data once they're online, a repository for their real-time data to come back as a feedback loop. This helps the generation interconnection process and the post commercial operation compliance requirements a generator needs to meet.

Better preparation of applications would allow us for more efficient studies, faster identification of potential issues, and quicker decision-making throughout the study process. Lastly, this also reduces the administrative burden on the utility and the interconnection customers so that we can be more effective and efficient in our interconnection process.

What are we asking our community of innovators? How can AI reimagine the generation interconnection validation process, reduce the human struggle, and ensure accurate generator modeling to maintain great reliability?

[MUSIC PLAYING]

OK, all right. The next topic we would like feedback from this community of innovators is how do we leverage the intrinsic utility knowledge that we have that can help our customers site their projects and the utility to optimize capacity planning solutions.

The most common question asked by a new business owner or a generation customer is, where should I site my project. Everyone at PG&E gets asked this question, or which transmission circuit or distribution circuit has capacity where that could serve my load or generation project. Unfortunately, the challenge is, there is no single data point that can efficiently answer this question today.

However, as a utility, we have a wealth of knowledge. We know real-time data of our transmission and distribution facilities. We know what is the outage and reliability index of our history of those transmission and distribution circuits. We know through our annual T&D planning process where we are planning future capacity projects. We know historical hourly load profiles, both at the system level and at the connected load level.

From the [INAUDIBLE] public queue, we know where generation customers want to connect. We also know from our annual studies where there would be good options for grid-enhancing technologies, like power flow controllers or dynamic line ratings that can help us mitigate some of those traditional planning solutions. Also, we know which substations have room for expansion or have one more position for a project to connect.

We also know from our GIS data what would right of way look like for you to site your project through a new distribution or transmission line. We know where telecommunication paths exist. We know what design standards the utility and the interconnection customer needs to adhere to. And we also, through utility knowledge, know what our typical cost estimation it would take to connect your project.

does

This information, with all of this abundant utility data, we can drive a more strategic, adaptable, and integrated transmission and distribution planning approach that incorporates scenarios that are using more scenario-based and probabilistic grid planning methodologies, alongside with a solid engineering and implementation plan. With this tool, we can empower both the utility and the interconnection customer to visualize this data, the collective data, in a map that can help you site your project and can help us better serve our customers. With that, our question for you is, how can AI use utility data to help PG&E customers make better decisions and consider complexities of local needs to site their projects effectively?

[MUSIC PLAYING]

So Ashwini outlines many of the siting challenges that our interconnection customers face. And we, as the utility designing our distribution and transmission projects, we face many similar challenges. We have to ensure that the design of our circuits is optimized to be as quick to build as possible to serve our customers. That means we need to consider right of way, permitting obstacles, habitats, plans that future agencies may have so we can coordinate with them and build alliances with them, and access to our equipment, as well as clearance windows for our assets.

All of that is a complex set of local knowledge that needs to be accounted for in the design of our new projects. And as I mentioned earlier, we're working with our vendors to automate many aspects of our planning process so that our distribution engineers can look at a wider variety of future scenarios more quickly. And along with that automation, we can imagine AI or automation tools proposing suggested distribution or substation project designs that could serve a certain customer load or a load growth in an area. The challenge is how would an automation system like that be aware of these local constraints, these complex web of local issues that could be the thing that makes or breaks a construction project.

So as we think about how we want to engage you, our community of innovators, we want to know how AI and ML tools are being constructed to use all of the data and local knowledge that customers have to, in the automated design and solutioning of various systems, maintain awareness of all of those complex local constraints. So the specific question here is how might we automate capacity mitigation design, which would enable engineers to streamline the solutioning process in a way that accounts for the complexities of local needs and challenges.

[MUSIC PLAYING]

All right, hey, thanks for answering those questions. And we'll be getting to those responses shortly. I'm just going to mention, please provide the name of your company or organization. It's optional, but if you can provide that, please do so. Thank you.

So in conclusion, right, we've heard a lot today, this morning's session as well as here, PG&E has the challenge of connecting a lot of load as well as a lot of generation, right? We've finally seen that the load forecast and the generation forecasts that we're seeing from the California Energy Commission are now aligning with the state's policy goals. And we can see that in order to meet that, we're going to have to change the way we do planning here at PG&E.

Based on the resource requirements, we have to connect 7,000 megawatts of renewable generation in the state over the next decade or so in order to meet our clean energy goals. That's a huge challenge. That's not what we're connecting today in the state. At the same time, from building electrification as well as transportation electrification, we're going to see the load growth skyrocket in the coming years. On top of that, we have data centers. So great opportunities, but we got to figure out how we're going to do that.

The status quo for load and generation interconnection needs to change. To meet these demands at the lowest cost, while still building for the future, we need to model more hours of the year, more nodes of the circuit, more years of the forecast, and still complete all our studies quickly. These advanced studies require more granular input data to match our complex data models. Customer load inputs need [INAUDIBLE] shapes, so that we can compare them with our hourly load forecasts to identify off-peak and flexible service opportunities. And generator models require detailed knowledge of inverter and controller characteristics to capture dynamic behaviors like fault response.

With all that, what do we need from all our vendor partners Work with us to develop industry-leading tools that streamline and automate the capacity modeling process. Allow customers to build granular load and generation models as they fill out their applications. Develop AI and ML tools that can help generator developers build, test, and validate their application packages. Aligning and standardizing our data models will enable us to find the best ways to serve at the lowest cost to ratepayers, while still speeding up customer review timelines.

But customers don't want just faster utility review timelines. They also want to make sure that they can avoid study outcomes that will extend the timelines of their projects. To reduce these utility interconnection wait times, we need siting and design tools that identify negative study outcomes as early as possible. We want to optimize interconnection sites and circuit designs to minimize T and D needs and costs.

As any developer or builder knows, choosing the right site can make or break a construction project's budget and schedule. Successful siting of new generation and load projects is dependent on the alignment of several factors, which collectively determine the fastest pathway to achieving commercial operation. This includes strategically placing projects that connect to existing substations with available space for expansion or areas with available transmission capacity that can minimize the need for new transmission or distribution lines.

It also means designing distribution circuit upgrades that minimize project dependencies, like lengthy permitting. All of this requires automated design and siting tools that are fully aware of detailed local constraints. Targeted siting and design can reduce costs, expedite project timelines, and lessen the environmental impact of expanding transmission and distribution networks. We're excited to work with this community of innovators to bring our hometown knowledge into our tools to serve our customers better.

Great, now, let's go ahead and take a look at your answers to the Slido questions. All right, so this one's for you, Brad. If you want to take a look over my shoulder. And we've got the answers up here. These are the most common answers.

So what tools and technologies are available to build an accurate hourly shape? Smart meters, AMI data analytics, similar store/facility profiles, AI/ML models and forecasting tools, as well as building energy models and the standards. And so just take a look through that. Is there any of those that you really feel like might have the biggest impact in order?

Sure.

I think you've got--

Oh, I've got the live ear mic, cool. Well yeah, absolutely. AMI data is essential and PG&E in our distribution planning process last year went from using SCADA data as the basis for our circuit load peaks to using hourly AMI data. So that is absolutely the starting point for understanding historical load profiles and having the data basis to create typical customer load shapes.

The bullet point here, I think, the next step is the using AI and ML models. That's allowing us to create a greater diversity of load shapes for customers. That's consuming fresh AMI data as soon as it comes into our system so that we're catching evolutions in customer operational types, because there are only so many residential communities that are all electric so far.

And so in order to get a good picture of what those will look like, we need to capture the new data from them as soon as they come online, or same for fleet EV charging and freight EV charging. These are things where we have to build the shapes as quickly as possible. So that's what we see as the next step forward. And we're looking forward to working with our vendors to integrating those capabilities, yeah.

Great. All right, Nash, we need the second one. If we move to the second answer up here, let's make sure we've got the second one. Great, so how can AI re-imagine the generation interconnection validation process to ensure accurate generator modeling? So these are the most common responses that the audience provided you here. And of the AI-driven improvements that you see here, do any of these jump out at you as having the greatest potential for transforming the interconnection process?

Yeah, I really like all of the responses. I love the real-time interactive feedback. So if we had a chatbot that could do this, that means my engineer now doesn't have to do this feedback manually. But we had a chatbot that could provide those responses. I think that would be a great option.

Use AI for rapid model validation, catch errors. All of these are aligned with the solutions we're looking for. And yes, we also have a big part to play. We can tell you what those utility standards are, what those transformer, where is it Y-grounded delta, is it delta-delta. That data, we could do better by helping standardize the data format. So I think these are really good solutions and good ideas.

Great, excellent. All right, so the next question we actually did, if we-- great, it's up here. So how can AI use utility data to help PG&E customers make informed decisions to site their projects effectively?

We broke this, the answers here, out by the segments that you all answered. So we have folks from utility industry, partners, vendors, as well as researchers and academics. And looking through the answers, they really are quite different. So Ashwini, I'd just love for you to take a look and give us any of your comments on-- make this a little bit larger for you-- on anything that stands out to you.

So I do like one of the vendor questions. And this is the out-of-box thinking that we were hoping to work with you. I never thought of putting these two things together, but develop automated site assessment tools using remote sensing and permitting workflows. Now, we never thought in traditional capacity maps to take this as a data point. So I think this is a really good one. [INAUDIBLE], Brad, if there's anything else you like.

Yeah, use AMI data, that actually is what Brad was talking about, to generate some of these detailed capacity maps. Yeah, create real-time capacity maps showing available interconnection points and hosting capacity. There was a FERC order all about heat maps that does exactly this, one for generation. I think these are the end goal of this request. So anything?

No, I think all those ones listed there are great. It's good to see all the participation.

Yeah, and one thing that jumps out to me is in the utility is making data more openly available and transparent. And is that also in line with, on the last one on the researcher academic, being able to maintain privacy through strategic data abstraction.

Yes.

Yes.

Definitely, I think that's a good call out, yeah.

So is there anything that you guys are thinking of as far as creating that transparency but still maintaining the privacy?

I think there is data that cannot be public. That's customer sensitive data or infrastructure that is critical. That cannot be, but there could be always alternative solutions to provide that data. Maybe it's scrubbed for confidentiality and then provide it. So there could be some solutions there.

And if you look at our ICA maps today or our grip data portal, which provides visibility of capacity constraints on our circuits, those you will find certain circuits that are redacted because there's a single customer fed by that circuit. And we can't provide information about them. But that's an enormous manual undertaking today, when we prepare our grid needs assessment filings to go through and identify which data meets those criteria. Not fully manual, but Excel based work. And having better tools that can recognize that automatically would be a great benefit to us.

And that's always going to be a need. We can't share confidential data, whether it's our own or customers'. So coming up with a tool that can do that, instead of manually doing that and redacting it, it's not the optimum way.

Yeah, OK, great. And then, the last question we also sliced this by response segment. And we have government also here as a segment. So how might we automate capacity mitigation design and enable engineers to streamline the solutioning process in a way that accounts for the complexities of local needs and challenges? This one just came up, so I haven't had a chance to take a look at that yet.

Yeah, I got to squint a little bit.

Yeah.

I think this combining satellite imagery with AI asset identification is definitely something that can quickly benefit us. I mean, I think that it's easy to imagine a computer vision model that can create that asset level awareness and then true up the existing geospatial layers that we have. We have all of our poles, our assets, our maps. We have layers representing parcel boundaries or riparian waterways.

But all of those things, you often find them a few meters off of the imagery that you see. And you also then I don't know if the image you're looking at is correct, because it might come from one geospatial picture from one satellite. But a tool that can look across all those different data sources to triangulate what's the likely best source of information would be a huge benefit to us.

Great, and all of these answers we'll be sharing back, as well as all the different cuts of data. And I know that PG&E is going to be sharing more of this out as well, because this is a lot to take in on one slide. All right, so thank you so much. And I'll turn it back over to you to close out the session.

All right, thank you. First of all, just thanks for everybody attending and also for providing your responses. And then, I also want to thank Brad and Ashwini. I think they did a wonderful job in discussing our topics and our challenges.

And we look forward to reviewing all the data. That was quick. That was a couple of minutes of looking at the responses you made. The responses will be slice and dice many different ways. And we will look at them and see what best fits each one of our challenges. Again, really appreciate you attending. And it was a wonderful session. So thank you.

[APPLAUSE]

[MUSIC PLAYING]