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**IEPR Commissioner Workshop on Load Modifier Inputs and Assumptions
(Docket No. 26-IEPR-03)**

**Monday, August 31, 2026
9:00 a.m.–12:30 p.m.**

Remote Access via Zoom™

<https://zoom.us/> Webinar ID: 867 8083 8917 Passcode: 2026

This transcript may contain errors

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00:00:00.620 --> 00:00:04.049

Kenny Sanders: And we are now recording your live.

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00:00:05.100 --> 00:00:09.989

Sandra Nakagawa: Good morning, everyone. We're gonna give it just a minute while folks file into the virtual room here.

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00:00:15.000 --> 00:00:27.220

Sandra Nakagawa: Alrighty, thank you for joining today's Integrated Energy Policy Report, or IEPR Commissioner Workshop, on the Load Modifier Inputs and Assumptions. I'm Sandra Nakagawa, Director of the IEPR at the CEC.

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00:00:27.380 --> 00:00:34.600

Sandra Nakagawa: Today's workshop is part of the CEC's 2026 IEPR Update Proceeding, and it is being held remotely on Zoom.

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00:00:34.800 --> 00:00:41.499

Sandra Nakagawa: It's being recorded, and both the recording and a Zoom transcript will be posted on the CEC website after the workshop.

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00:00:41.630 --> 00:00:48.109

Sandra Nakagawa: You can also find the schedule and slide decks for today's presentations on the webpage for this workshop.

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00:00:48.550 --> 00:00:53.509

Sandra Nakagawa: Throughout the day, there will be opportunities for the public to ask questions of presenters.

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00:00:53.660 --> 00:00:58.020

Sandra Nakagawa: To do so, you can submit your questions using Zoom's Q&A feature.

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00:00:58.180 --> 00:01:07.019

Sandra Nakagawa: You can also look at the questions that have been submitted already, and upvote those with the thumbs up icon. That'll help move them to the top of the list.

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00:01:07.200 --> 00:01:10.999

Sandra Nakagawa: Please note that we might not have time to address all questions today.

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00:01:11.830 --> 00:01:21.440

Sandra Nakagawa: At the end of the workshop, we will have a public comment period. To participate in that, you can use the raise hand feature to let us know that you would like to make public comment at that time.

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00:01:21.630 --> 00:01:33.540

Sandra Nakagawa: Comments are limited to 3 minutes per person, with 1 person per organization allowed to comment. Although we won't be responding to comments during the public comment segment, all remarks will become part of the public record.

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00:01:34.040 --> 00:01:42.920

Sandra Nakagawa: We also welcome written comments. Those are due by Tuesday, September 15th, and you can find instructions for how to submit them on the workshop notice.

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00:01:43.290 --> 00:02:05.120

Sandra Nakagawa: So, on the dais this morning, we have... this morning, we have Commissioner McAllister from the Energy Commission, Rajinder Sahota, Deputy Executive Officer for Climate Change at the California Air Resources Board, and while Vice Chair Gunda is listed on the workshop schedule, he is unable to make it today, so we have Qing Tian, an advisor for Vice Chair Siva Gunda, who will be representing his office.

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00:02:05.160 --> 00:02:10.039

Sandra Nakagawa: With that, I'm now going to hand things over to Commissioner McAllister for opening remarks.

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00:02:10.460 --> 00:02:27.510

Commissioner Andrew McAllister: Great, well, thank you very much, Sandra. And, yeah, really looking forward to today. This is a pretty, sort of, technical workshop, but really fundamental to the way we do forecasting in California. And unfortunately, as Sandra said.

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00:02:27.660 --> 00:02:38.709

Commissioner Andrew McAllister: Vice Chair Gunda can't join us today, but Qing Tian will sub in for him. And we're also very fortunate to have Rajinder Sahota from the California Air Resources Board, who really has been a stalwart partner

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00:02:38.750 --> 00:02:52.769

Commissioner Andrew McAllister: an incredible representation, of the representative of the ARB, just throughout, in terms of all the, you know, obviously energy and carbon emissions are intimately related.

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00:02:52.770 --> 00:02:59.770

Commissioner Andrew McAllister: And we have to be careful how we steer and how we coordinate across the agencies and the Air Resources Board, along with the PUC,

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00:02:59.770 --> 00:03:10.030

Commissioner Andrew McAllister: Have been, real, just stalwart partners in that, interagency collaboration, and happy to continue that today.

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00:03:10.200 --> 00:03:21.330

Commissioner Andrew McAllister: Load... I'll be brief, but I wanted to just point out that load modifiers are an incredibly important part of the overall forecast to go from

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00:03:21.440 --> 00:03:32.130

Commissioner Andrew McAllister: The, consumption forecast, sort of as a whole, just all the consumption that takes place, the demand drivers.

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00:03:32.130 --> 00:03:48.620

Commissioner Andrew McAllister: And then, roll... include all of the different, wedges, pluses and minuses, all the different evolution patterns that we have in California, all the behind-the-meter resources, the transportation, electrification, energy efficiency, which, you know, all have been, particularly efficiency, have been long-term

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00:03:48.730 --> 00:04:13.480

Commissioner Andrew McAllister: fundamental policies that we've enacted over the last half century in California. And so, you know, we have the highest number of PV systems of any state, many of those now attach to batteries, which are, in some ways, a real game changer. We have very assertive efficiency policies, building code, appliance, now we have a lot of load flexibility initiatives that we're trying to piece together that puzzle to ensure that

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00:04:13.740 --> 00:04:29.539

Commissioner Andrew McAllister: that load flexibility can, you know, in aggregate and in targeted ways, really enhance the reliability and manage cost of the grid going forward. And California's really making big efforts to be a leader in that space.

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00:04:29.780 --> 00:04:46.950

Commissioner Andrew McAllister: Decarbonization of buildings and appliances and transportation, obviously, is, the energy piece of it, the electrification as a fundamental policy direction of California, is driven by our decarbonization goals, in large part.

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00:04:47.060 --> 00:05:02.840

Commissioner Andrew McAllister: We also have technologies like heat pumps that are inherently efficient, and so efficiency and decarbonization really go hand in hand as we lean into the backbone of our decarbonization journey, which is electrification, which is the clean, increasingly clean electric grid.

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00:05:02.870 --> 00:05:18.610

Commissioner Andrew McAllister: So, all of these load modifiers are really important to, understand in depth, to be able to roll those up with the demand forecast to what we call a managed forecast. And so, today we'll hear from

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00:05:18.610 --> 00:05:32.130

Commissioner Andrew McAllister: a bunch of Energy Commission experts, a number of subject matter experts. The depth of our bench here in the Energy Commission is just... never ceases to impress me, certainly. And you'll hear from a number of those, and behind each one that presents.

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00:05:32.200 --> 00:05:39.120

Commissioner Andrew McAllister: You know, around, electricity rates with LIN, and then 100 meter solar battery, and transportation electrification.

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00:05:39.210 --> 00:05:58.100

Commissioner Andrew McAllister: with Bobby and Mark and Andre, you'll, you'll... behind each one of them is a huge bench of subject matter experts and analysts that really are, are top level. And then finally, efficiency and fuel substitution, with Ethan and Jonathan. So, really a great,

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00:05:58.240 --> 00:06:04.650

Commissioner Andrew McAllister: bench of, presenters today, and looking forward to folks' input, and, and...

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00:06:04.690 --> 00:06:18.270

Commissioner Andrew McAllister: questions and observations, both today and in written comments later. I want to just thank everyone who, is attending. This is a fairly specialized topic that, I think,

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00:06:18.630 --> 00:06:36.070

Commissioner Andrew McAllister: we really, you know, need to engage, not just with the utilities, but all sorts of trade allies and technologists and technology providers, and also implementers, so that we can understand each one of these and really make sure we're not

missing anything, because, you know, it's an ever-changing landscape, especially California, where

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00:06:36.070 --> 00:06:44.679

Commissioner Andrew McAllister: we have a lot of, you know, we really have an innovation economy, and I think, load modifiers, as I was kind of alluding to.

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00:06:44.840 --> 00:06:56.170

Commissioner Andrew McAllister: in California are just a bigger deal than almost anywhere else in the world, arguably than anywhere else in the world, and so it's really important that we get to a managed forecast that's reasonable.

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00:06:56.250 --> 00:07:15.639

Commissioner Andrew McAllister: you know, those of you who live in a house that has solar batteries, maybe you have an EV, you know, you consume and sort of, you know, you know that your meter is modulated, you know, it's sort of... the electricity flows, you know, switch directions, but not, you know, you're not actively aware of that. Well, we have to really understand how all of that adds up.

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00:07:15.800 --> 00:07:18.699

Commissioner Andrew McAllister: In terms of what the grid actually sees.

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00:07:18.940 --> 00:07:32.650

Commissioner Andrew McAllister: And so that's the idea here, is that all of these, all of these individual load modifiers have a lot of behavior driving them, and understanding how that plays at the different levels of the grid, and sort of an aggregate.

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00:07:32.650 --> 00:07:45.970

Commissioner Andrew McAllister: is what we're trying to get a handle on, and it's a... it's an ever-changing landscape, and one that, takes a lot of work and expertise to keep on top of. So, sorry that, that Vice Chair Gunda can't join us, but, I know he's here in spirit, and,

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00:07:45.970 --> 00:07:53.070

Commissioner Andrew McAllister: And we'll really be interested in everyone's presentations and the comments that attendees have.

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00:07:53.120 --> 00:08:00.489

Commissioner Andrew McAllister: And we'll make. So, with that, I think I will, pass the...

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00:08:00.780 --> 00:08:12.799

Commissioner Andrew McAllister: the mic, to Qing to, make some comments on behalf of Vice Chair Gunda, and then we'll move to... to Rajinder Sahota from the ARB. Over to you, Qing.

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00:08:14.680 --> 00:08:24.429

Qing Tian: Thank you, Commissioner McAllister. Good morning, everyone, and welcome to the workshop today. This is Qing. I'm an advisor to Vice Chair Siva Gunda.

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00:08:24.640 --> 00:08:38.049

Qing Tian: He is, unfortunately under the weather today, so I will be representing him for today's meeting, and he sent his regards and wish he could be here for the discussion, and this is a very

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00:08:38.280 --> 00:08:42.030

Qing Tian: Interesting topic to him, also.

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00:08:42.289 --> 00:08:52.559

Qing Tian: Commissioner McAllister has articulated the importance of load modifier. I'm not going to repeat what he said. Just wanna...

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00:08:52.990 --> 00:08:58.439

Qing Tian: thank our IEPR and Energy Assessment Division team for the significant work.

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00:08:58.650 --> 00:09:02.380

Qing Tian: That went through today's Workshop, and we're so gonna thank

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00:09:02.680 --> 00:09:14.650

Qing Tian: our colleagues at CPUC, CAISO, CARB, Utilities, and all the stakeholders who continue to engage with us and help make our work product

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00:09:14.860 --> 00:09:22.840

Qing Tian: as rigorous as possible, and the collaboration has always been a very important part of our IEPR process.

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00:09:25.440 --> 00:09:37.790

Qing Tian: Lastly, I will be looking forward to today's presentation also, and discussion. Our goal is to continue to make improvements and make our forecast work product

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00:09:37.790 --> 00:09:46.530

Qing Tian: as transparent as possible, as they provide a strong backbone for California's energy planning process.

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00:09:46.820 --> 00:09:52.589

Qing Tian: With that, thank... thank you for the opportunity to listen in,

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00:09:53.040 --> 00:09:56.620

Qing Tian: I'd like to hand it to the... back to Commissioner McAllister.

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00:09:57.920 --> 00:10:04.099

Commissioner Andrew McAllister: Thanks, Qing, and all of us wishing Vice Chair Gunda a speedy health recovery.

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00:10:04.620 --> 00:10:16.299

Commissioner Andrew McAllister: So, Rajinder, thanks so much for being with us. I really appreciate you and everything the Air Resources Board does, and the partnership that we have together, trying to track all the amazing developments. I mean, it seems like every day there's a...

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00:10:16.380 --> 00:10:30.979

Commissioner Andrew McAllister: new story about how things are scaling, and innovation that's happening, and both challenging and also, you know, huge opportunities. I'll just note, a couple weeks ago, we did an updated workshop on large loads.

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00:10:30.980 --> 00:10:39.659

Commissioner Andrew McAllister: A little bit of data center discussion, so not on the agenda for today, but definitely, you know, another one of these, forecasting

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00:10:39.960 --> 00:10:55.909

Commissioner Andrew McAllister: both challenges and opportunities that we're trying to get a handle on as that, as that sort of market and arena evolves quickly, so another... another place for, for us to keep tabs and collaborate. Thanks for, again, for being here. Thank, over to you, Rajinder.

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00:10:56.950 --> 00:11:15.480

Rajinder Sahota: Yes, good morning, everyone, and thank you, Commissioner McAllister, for those kind words at the beginning about the collaboration across the two agencies. Obviously, energy and climate are intertwined, because the success on climate is dependent on the success of transitioning away from fossil fuels.

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00:11:15.480 --> 00:11:17.559

Rajinder Sahota: Two, clean electricity.

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00:11:17.560 --> 00:11:23.030

Rajinder Sahota: And just the other week, I was at a public listening session, and I was referred to as a technocrat.

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00:11:23.030 --> 00:11:48.019

Rajinder Sahota: And, I told the staff, if that means we care about data modeling and science, I'm okay with it, because that has to underpin policy, good policies, based on good technical work by experts at agencies such as CARB and the CEC. So I took that as a compliment, even though it wasn't intended that way. But today, on the workshop, I think it's really important for everyone to realize that every one of these little

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00:11:48.020 --> 00:11:57.259

Rajinder Sahota: modeling tasks that the staff does at CEC, or even at CARB, or any of the state agencies, they're another data point to help inform

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00:11:57.260 --> 00:12:07.140

Rajinder Sahota: the state's path forward. They speak to the growth and demand, the build-out, the costs, affordability, which is front and center.

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00:12:07.140 --> 00:12:24.480

Rajinder Sahota: And then also about where the state is going on deploying clean technology downstream. So we know right now that, you know, CARB's regulations on vehicles, would be a big, big driver on electricity demand. Just as we keep talking about data centers, we have transportation, which is

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00:12:24.480 --> 00:12:30.130

Rajinder Sahota: the largest source of unhealthy air pollution, unhealthy air in the state of California.

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00:12:30.450 --> 00:12:50.279

Rajinder Sahota: During this period of uncertainty, with the CARB regulations and the unlawful actions of the federal government, how we think about a future, and how we think about the grid, and how we think about demand growth is even more important. We're gonna fight for that right, to be able to have clean air for everyone that lives in the state, and to keep pushing for that outcome.

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00:12:50.280 --> 00:12:56.329

Rajinder Sahota: But we also need to take a look, as we do periodically in activities like the IEPR and the scoping Plan.

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00:12:57.370 --> 00:13:17.449

Rajinder Sahota: where are we, what are we doing? How do we update and reflect the latest data, the latest landscape for regulations? So, I'm excited to be here this morning, and join the discussion. Really want to thank the staff for all the hard work that they do. It's their work that allows people like myself to be able to talk about the outcomes and the path that California is taking.

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00:13:17.450 --> 00:13:28.509

Rajinder Sahota: And just really appreciate, again, the invite to be here and the collaboration at the senior level across the leadership, not just at the staff level. So, thank you. Look forward to the discussion.

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00:13:29.030 --> 00:13:34.539

Commissioner Andrew McAllister: Thanks so much, Rajinder, and yeah, right back at you in terms of the importance of the scoping plan.

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00:13:34.660 --> 00:13:45.829

Commissioner Andrew McAllister: Really, I think the, you know, the scoping plan and IEPR complement one another very well, and I'll just note that our staffs, at many levels, are working together on... across the board, obviously on transportation.

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00:13:46.040 --> 00:14:01.070

Commissioner Andrew McAllister: the evolution of transportation and electrification of transportation, which is actually the biggest load growth driver, as far as we can tell, more so the data centers and other load drivers. Building electrification is kind of coming along, but still, like, transformation is the big dog.

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00:14:01.170 --> 00:14:05.050

Commissioner Andrew McAllister: In terms of, new loads right now throughout the distribution grid.

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00:14:05.110 --> 00:14:12.519

Commissioner Andrew McAllister: And so, just, you know, another, we're working together on, on many fronts, building electrification.

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00:14:12.560 --> 00:14:27.859

Commissioner Andrew McAllister: Trying to figure out the heat pump, adoption patterns that are emerging, and trying to juice those. So, really just a lot of great work together, together with the PUC, obviously, as well as the Air Resources Board. I think we're all holding hands really tightly in collaboration with the CAISO.

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00:14:27.910 --> 00:14:30.719

Commissioner Andrew McAllister: To make sure the reliability is front and center.

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00:14:31.100 --> 00:14:34.719

Commissioner Andrew McAllister: So, with that, I think,

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00:14:35.240 --> 00:14:43.340

Commissioner Andrew McAllister: I'll pass it, back to, Sandra, and maybe you can, kick off the first

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00:14:43.610 --> 00:14:45.710

Commissioner Andrew McAllister: presentation with Quentin.

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00:14:45.990 --> 00:14:47.879

Sandra Nakagawa: Thank you, Commissioner McAllister.

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00:14:47.880 --> 00:14:50.349

Commissioner Andrew McAllister: Thanks for all the work, Sandra, really appreciate you and the team.

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00:14:50.350 --> 00:15:02.950

Sandra Nakagawa: and Rajinder as well. We're gonna go over to Quentin Gee. Quentin is a manager in our Advanced Electrification Analysis Branch, and he's gonna set the stage with an overview and updates, about what we're gonna hear today.

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00:15:04.060 --> 00:15:07.030

Quentin Gee: Great, thank you, Sandra. Thanks, everybody.

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00:15:07.170 --> 00:15:17.370

Quentin Gee: And, welcome to the IEPR Workshop on Load Modifiers... Load Modifier Inputs and Assumptions. This is the second

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00:15:17.450 --> 00:15:38.189

Quentin Gee: Workshop pertaining to the IEPR forecast that we've had. The previous workshop that we had on August 20th related to the economic and demographic inputs that go into the forecast, the known loads issue, which is sort of loads that have been requested for by customers in IOU territories.

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00:15:38.250 --> 00:15:40.840

Quentin Gee: Or investor-owned utility territories.

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00:15:41.160 --> 00:15:54.359

Quentin Gee: We also discussed data centers, and had a good discussion on forecasting perspectives from various, what we call load-serving entities, or folks that, serve, sort of, a utility or power delivery.

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00:15:54.360 --> 00:15:56.530

Quentin Gee: Role for their...

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00:15:56.530 --> 00:16:20.250

Quentin Gee: for the customers in their area. So that was a really great workshop, we learned a lot. This time we're going to get into the other load modifiers. Data centers technically are a load modifier, but today we're focused, to a large degree, on load modifiers. So, what is a load modifier? It is a source, or a new, sort of, generally new source of

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00:16:20.360 --> 00:16:37.050

Quentin Gee: electricity demand that is distinct from standard economic and demographic drivers. So, you can imagine that if the state were to just sort of have, you know, 1 million more people, or 2 million more people living in it, you know, those folks, you know, are going to

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00:16:37.380 --> 00:16:49.050

Quentin Gee: consume electricity, they're going to, you know, have all these different sorts of power demand associated with just living their lives, you know, air conditioning, etc. By contrast.

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00:16:49.050 --> 00:16:57.719

Quentin Gee: sort of load modifiers, like data centers. They're new, they have a distinct load profile, their hourly sort of demand differs from folks

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00:16:57.720 --> 00:17:03.940

Quentin Gee: who are just living their lives. The same thing happens with energy demand from

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00:17:03.990 --> 00:17:18.580

Quentin Gee: behind-the-meter photovoltaics, so rooftop solar systems, also if they have batteries, electric vehicles, these are, as Commissioner McAllister pointed out, these are a very large source of energy demand expected in the future.

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00:17:18.579 --> 00:17:35.279

Quentin Gee: And then we also have efficiency programs that have the distinct impacts on the load, and as well as fuel substitution efforts, or things like heat pumps and other forms of building electrification technologies and other technologies. So these are all really critical

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00:17:35.730 --> 00:17:42.200

Quentin Gee: Impacts, or things to consider when conducting the energy demand forecasts that we do.

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00:17:42.200 --> 00:17:55.770

Quentin Gee: And, that forecast does play a critical role in investment decisions for resource procurement. So, for example, new power plants. It affects transmission investments, so you could sort of think of those big, huge.

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00:17:55.770 --> 00:18:04.090

Quentin Gee: Power lines that you can see if you drive along the highway and sort of, you know, or see a big, huge substation out there. That's oftentimes transmission.

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00:18:04.090 --> 00:18:18.629

Quentin Gee: level, infrastructure. And then, of course, you know, at the distribution level, just the power lines that you see, in your local area. Those... the forecast is a critical input on those, providing a sort of an independent

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00:18:19.010 --> 00:18:30.059

Quentin Gee: and data-driven sort of framework for thinking through how all those different aspects of energy demand are going to play out. So...

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00:18:30.120 --> 00:18:49.820

Quentin Gee: Really critical and important, and we're going to have a good discussion today on load modifiers, but to kick things off, we are going to have a discussion on the electricity rate forecast, which is related, not a load modifier, of course, but is a critical input into our work as well. And for that, rate forecast, we have Lynn Marshall, who's going to sort of

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00:18:49.820 --> 00:18:59.479

Quentin Gee: Discuss a little bit of the updates related to the electricity rate forecast and take any questions that the commissioners or the audience have.

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00:18:59.850 --> 00:19:00.660

Quentin Gee: Lynn?

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00:19:01.400 --> 00:19:14.230

Lynn Marshall: Okay, good morning, everyone. So I'll be discussing, as Quentin said, the major changes that were made for the rate forecast this year, and then I'll be presenting planning area and statewide results.

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00:19:14.580 --> 00:19:26.280

Lynn Marshall: So you can go a couple slides ahead, but first I'll give an overview of the way we construct the rate forecast. Let's go... there we go, stop here.

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00:19:26.380 --> 00:19:42.779

Lynn Marshall: So basically, we're combining data from utilities and load-serving entities on their costs and rate-making developments with CEC forecast, assumptions and inputs.

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00:19:42.860 --> 00:20:02.709

Lynn Marshall: So for power procurement, we're getting from, larger utilities and LSEs, supply plan projections, their projected costs for those resources, and then we're combining that with staff production cost modeling and energy price forecasts.

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00:20:02.950 --> 00:20:10.820

Lynn Marshall: On the kind of wire side of things for transmission and distribution and other things like public goods charge program...

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00:20:11.440 --> 00:20:24.310

Lynn Marshall: funding. We're also looking at LSE's projected revenue requirements, but also at rate-making developments, activity in GRC proceedings. There's some

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00:20:24.310 --> 00:20:44.190

Lynn Marshall: several reports from IOUs that the CPUC requires that are quite useful, and we also sometimes look at analyses by interveners, and use all that information to build out a forecast of total annual revenue requirements. That's allocated to the major sectors

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00:20:44.730 --> 00:20:50.809

Lynn Marshall: consistent with the cost allocation and recent historic rates.

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00:20:52.320 --> 00:21:06.749

Lynn Marshall: And then we divide those revenue requirements by our forecasted sales. So what we have is an annual average rate, it's all in, we're not addressing things like demand charges or monthly fees, right?

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00:21:06.750 --> 00:21:16.579

Lynn Marshall: So those rates, then, are an input into our sector and self-gen models, also fuel price forecasts and transportation modeling.

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00:21:16.610 --> 00:21:27.709

Lynn Marshall: It is also used for cost-effectiveness analysis of regulations and standards, both here at the CEC and at the Air Resources Board.

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00:21:28.790 --> 00:21:41.560

Lynn Marshall: So, now we can go to the next slide, and we'll talk about, major changes we made this year. So, next slide. On the generation side of things,

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00:21:42.140 --> 00:21:59.409

Lynn Marshall: we start the base portfolio costs from data we've got from LSEs and recent CPUC applications, but going into 2030, we are using, results from our recent

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00:21:59.580 --> 00:22:04.300

Lynn Marshall: 2026 California Energy Resource and Reliability Outlook (CERRO).

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00:22:04.510 --> 00:22:17.869

Lynn Marshall: So, what the CERRO team did was evaluate the cost and reliability of various pathways to meet our clean energy targets, 6.9 million metric tons by 2040.

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00:22:18.260 --> 00:22:20.610

Lynn Marshall: 2045,

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00:22:21.300 --> 00:22:34.039

Lynn Marshall: And what I'm showing here is the graph of three of their core scenarios, base, no CCS, no emerging technologies. So I've got the capacity added, and the total modeled costs.

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00:22:34.150 --> 00:22:41.630

Lynn Marshall: For this rate forecast, we're using the no emerging technology scenario, which, as you can see, is

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00:22:41.800 --> 00:22:53.129

Lynn Marshall: the most expensive, so why are we using that one? Well, the base portfolio is they're letting the model choose from all of the potential

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00:22:53.260 --> 00:23:04.739

Lynn Marshall: resources, in their pool. And that scenario has about 50% of our combined cycle fleet

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00:23:05.090 --> 00:23:09.160

Lynn Marshall: installing carbon capture

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00:23:09.330 --> 00:23:11.400

Lynn Marshall: and storage technology.

129

00:23:11.750 --> 00:23:31.449

Lynn Marshall: So, while that's an available technology, there are concerns about, well, that would require a large amount of storage in-state to be in place, and there's also concerns about whether that large a percentage of the fleet would be compatible, technologically compatible with the

130

00:23:31.480 --> 00:23:33.319

Lynn Marshall: the CCS technology.

131

00:23:33.730 --> 00:23:39.969

Lynn Marshall: So they also did a scenario just setting CCS aside. That model adopts a lot of geo...

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00:23:40.130 --> 00:23:42.830

Lynn Marshall: installs a lot of geothermal, I mean.

133

00:23:42.980 --> 00:23:52.209

Lynn Marshall: enhanced geothermal. And there's also concerns about whether that's really feasible at that large of a scale.

134

00:23:53.700 --> 00:24:06.579

Lynn Marshall: Yeah, the CERRO model is using the 2025 IEPR forecast, the planning scenario, which is also the sales forecast we're going to use for the rate forecast.

135

00:24:07.860 --> 00:24:25.800

Lynn Marshall: So the final scenario they did was we're going to take out all of the emerging technologies, and what that model produces is, not surprisingly, we're very reliant on solar plus storage. It adds something like

136

00:24:25.800 --> 00:24:30.259

Lynn Marshall: 40 gigawatts of solar PV, 15 gigawatts of storage.

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00:24:30.260 --> 00:24:36.790

Lynn Marshall: So we're adding a lot of capacity, really more than we need for energy purposes, but...

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00:24:36.990 --> 00:24:43.620

Lynn Marshall: So this is more expensive, it is a more conservative scenario, but it's kind of the sure thing in terms of meeting our clean energy goals.

139

00:24:44.160 --> 00:24:47.450

Lynn Marshall: So, let's go to the next slide.

140

00:24:48.290 --> 00:24:58.090

Lynn Marshall: We're also, from CERRO using their wholesale energy costs, so that's the day ahead and real-time price, plus ancillary services, etc.

141

00:24:58.340 --> 00:25:05.670

Lynn Marshall: So, what I'm showing here on the chart are some recent actual average CAISO

142

00:25:05.840 --> 00:25:20.780

Lynn Marshall: cost of service, along with forecasts. And so, we've been in this nice period, 2024, 2025, of low, stable energy prices. Gas prices have been not as volatile as, say, back in 2022.

143

00:25:22.250 --> 00:25:32.400

Lynn Marshall: The forecast for 2027, which is from one of the IOU's Year Ahead procurement forecasts, is also for continued low prices.

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00:25:32.590 --> 00:25:39.190

Lynn Marshall: As we move into 2030, which is the CERRO Price,

145

00:25:40.410 --> 00:25:52.889

Lynn Marshall: And they're using the EIA gas price forecast, which is pretty flat through the forecast horizon, but 2020-30, that's when Diablo Canyon retires, so we do see prices go up.

146

00:25:52.990 --> 00:26:07.430

Lynn Marshall: But then longer term, as we're adding all of this, solar and storage, we have lots of energy on the system, and prices actually decline. So the net effect, on generation rates

147

00:26:07.770 --> 00:26:15.290

Lynn Marshall: of the higher, capacity costs, lower energy costs, is about,

148

00:26:15.530 --> 00:26:21.049

Lynn Marshall: 2% real increase, mostly from 2035 to 2045

149

00:26:21.210 --> 00:26:30.019

Lynn Marshall: time frame in rates. So that's higher than what we had in the previous forecast, where generation rates were pretty flat. And those

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00:26:30.420 --> 00:26:37.830

Lynn Marshall: generation rates are increasing a little more in PG&E, a little less in San Diego, but it is going to have a noticeable impact on the rate forecast.

151

00:26:38.160 --> 00:26:45.429

Lynn Marshall: Now another input, let's go to the next slide, another input into those energy costs that CERRO and other

152

00:26:45.700 --> 00:27:05.340

Lynn Marshall: production cost models use is the GHG allowance prices. So, for natural gas plants, the GHG price is basically an adder to the fuel price. So, since the inception of the Cap and Invest program in California

153

00:27:05.550 --> 00:27:10.329

Lynn Marshall: CEC staff has been constructing scenarios of

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00:27:10.720 --> 00:27:24.749

Lynn Marshall: price outcomes for use in our production cost modeling. It's also used CPUC, CAISO, and a number of utilities across the WEC. So, typically, we construct

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00:27:25.140 --> 00:27:34.699

Lynn Marshall: High, mid, low scenario. Now, we're not doing our own modeling. What we do is look at the available analysis,

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00:27:35.030 --> 00:27:52.550

Lynn Marshall: and modeling by other parties, so in the early years of the program, there was a lot of work by economists at Berkeley that did some stochastic analysis that we could use to say, okay, here's a reasonable endpoint for our forecast period, and then we're going to solve for the price path that gets... gets us there.

157

00:27:54.280 --> 00:28:07.959

Lynn Marshall: So, the graph here is showing the basic structure of the cap and invest market. So, we have a price ceiling way up at the top. The light blue line is the price floor below which the auction prices, that they have

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00:28:07.960 --> 00:28:16.509

Lynn Marshall: four times a year, cannot go below that floor. And then there's a couple of dashed lines that are tier prices, and those are

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00:28:16.650 --> 00:28:18.580

Lynn Marshall: allowance containment

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00:28:18.860 --> 00:28:25.349

Lynn Marshall: price points, where if prices approach the APCR tier.

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00:28:25.550 --> 00:28:32.350

Lynn Marshall: CARB will make additional allowances available from the reserve, so that's... a lot of the modeling has found that

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00:28:32.450 --> 00:28:37.320

Lynn Marshall: Prices tend to be, slow or be sticky at a tier price.

163

00:28:37.440 --> 00:28:55.599

Lynn Marshall: So you can see in this chart the red line, which is the 2024 IEPR mid-scenario, which I believe is what CERRO was currently using for this last study, we were assuming that by the end of the forecast period, prices would approach the Tier 1 price.

164

00:28:57.270 --> 00:29:05.809

Lynn Marshall: So, if you look on the very bottom, there's a thick black line. Those are the actual auction prices, and as you can see, we really have

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00:29:06.150 --> 00:29:16.790

Lynn Marshall: not gotten there except for a brief kind of period where, there was a lot of institutional investor interest in, the... the...

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00:29:17.570 --> 00:29:20.049

Lynn Marshall: allowance product.

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00:29:21.340 --> 00:29:34.480

Lynn Marshall: Since then, prices have gone back to just above the floor. And now here in 2026, CARB has recently completed a new rule... set of rulemaking. They've

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00:29:36.120 --> 00:29:50.770

Lynn Marshall: formally, extended the program to 2045, and there's many other refinements that were made, but key for price formation is the addition of a manufacturing decarbonization incentive.

169

00:29:50.790 --> 00:29:57.470

Lynn Marshall: And so, the bottom-line effect of that is, it's financial support for

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00:29:57.670 --> 00:30:09.449

Lynn Marshall: facilities to decarbonize, so they're going to demand less allowances. That implies lower prices, so the market expectation is for lower prices at this time.

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00:30:09.620 --> 00:30:20.549

Lynn Marshall: We did just see the results of the third quarter auction, which prices went up a little bit, like, less than \$4, but we're still, like, well below that.

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00:30:21.200 --> 00:30:27.130

Lynn Marshall: dashed red line that we were looking at last time. So for this year's

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00:30:27.730 --> 00:30:31.439

Lynn Marshall: scenarios, what we're proposing is

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00:30:31.530 --> 00:30:44.750

Lynn Marshall: to assume that the final mid-case price would be halfway between the floor and Tier 1, so kind of a slower price path, still increasing because allocations do

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00:30:44.800 --> 00:30:59.440

Lynn Marshall: decline over time. And that is actually the same assumptions that CARB used for their regulatory impact analysis, although, to be clear, CARB does not do forecasts. All we're doing here is

176

00:30:59.440 --> 00:31:14.119

Lynn Marshall: coming up with reasonable scenarios that are hopefully helpful for use in modeling purposes. So, we'll be docketing a workbook, and we call that preliminary, and then usually what we do at the end of the year, December or January, after

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00:31:14.120 --> 00:31:21.010

Lynn Marshall: we've had all four auctions this year, and we know the price points for next year we'll docket at a final version.

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00:31:22.180 --> 00:31:28.229

Lynn Marshall: Okay, so we can go to the next slide, and we'll move on to the wire side of things.

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00:31:28.560 --> 00:31:31.050

Lynn Marshall: So, with the amount of...

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00:31:31.210 --> 00:31:47.739

Lynn Marshall: electrification that we're forecasting, we are expecting to require additional, grid... investment in grid enhancements, beyond what we've seen in, kind of, past trends of spending, right?

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00:31:48.400 --> 00:31:55.790

Lynn Marshall: So, Public Advocates Office has done a couple of studies now looking at the cost of these upgrades. They're doing...

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00:31:55.910 --> 00:32:12.369

Lynn Marshall: feeder level modeling, specifically looking at EV charging load shapes, building electrification impacts, and estimating the cost of remediating those impacts,

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00:32:12.580 --> 00:32:26.750

Lynn Marshall: For this, the 2025 study, which we're using now for this rate forecast, they made a lot of modeling refinements, including updated cost data. They are still using the

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00:32:27.090 --> 00:32:32.960

Lynn Marshall: planning, assumptions consistent with, actually, the 2023, IEPR

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00:32:34.050 --> 00:32:52.279

Lynn Marshall: planning scenario, the central scenario we're using is consistent with our AAFS and AATE 3 scenarios. So the net effect of these new cost data is the costs are much lower than what was assumed in the previous forecast, so

186

00:32:52.690 --> 00:32:58.759

Lynn Marshall: We helpfully got the annual expenditures that they're forecasting from

187

00:32:59.210 --> 00:33:11.730

Lynn Marshall: public advocate staff, so thank you for that. And then we converted that to revenue requirements. So that's added to kind of the baseline general rate case spending, but it is less than what we were forecasting last time.

188

00:33:12.920 --> 00:33:19.030

Lynn Marshall: Alright, and then the next slide... On...

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00:33:19.060 --> 00:33:32.839

Lynn Marshall: Couple of updates to the transmission side. We do get projections from the IOUs and other utilities on their long-run transmission plans. We supplemented that this year with data from

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00:33:32.840 --> 00:33:39.779

Lynn Marshall: CPUC Transmission Process Review Reports, so the utilities are now required to report

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00:33:39.780 --> 00:33:47.619

Lynn Marshall: I think once or twice a year, detailed project level, cost data, both,

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00:33:48.160 --> 00:33:57.739

Lynn Marshall: actual spending and projected spending, installation date, etc. So that's for both high-voltage projects that are,

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00:33:58.130 --> 00:34:08.040

Lynn Marshall: approved in the CAISO transmission planning process, but also lower voltage projects that the utilities have more discretion over, and that

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00:34:08.150 --> 00:34:15.759

Lynn Marshall: historically, we haven't had a lot of visibility on, so that's a... that's a useful data source for this. So, near term,

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00:34:15.949 --> 00:34:25.450

Lynn Marshall: the projected revenue requirements are a bit higher, particularly in PG&E, and then we're using the current trends to kind of trend out

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00:34:27.159 --> 00:34:35.949

Lynn Marshall: the forecast from there, the revenue requirement forecast from that point. Another change was with respect to

197

00:34:36.030 --> 00:34:41.979

Lynn Marshall: the data center load growth. So last year, because we were adding so much

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00:34:42.000 --> 00:34:58.230

Lynn Marshall: data center load in the forecast. We wanted to account for additional transmission upgrades that would be required. So last year, we used an assumption from a PG&E presentation to investors, which was very kind of high level.

199

00:34:58.230 --> 00:35:16.330

Lynn Marshall: This year, in the PG&E Rule 30 proceeding on large Load Interconnection, there was some more detailed data available, actual sample of project data, and that isolated transmission costs, separate from distribution, and

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00:35:17.080 --> 00:35:25.070

Lynn Marshall: it also showed that not all of the data centers that we've seen so far require or trigger transmission upgrades, so...

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00:35:25.220 --> 00:35:30.929

Lynn Marshall: that's a lower impact. So, last year I had a slide showing

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00:35:31.090 --> 00:35:33.610

Lynn Marshall: that, even after accounting for these

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00:35:34.480 --> 00:35:44.790

Lynn Marshall: upgrade costs, the net effect of the load growth was still downward pressure on rates, so that would continue to be true this year.

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00:35:44.940 --> 00:35:54.490

Lynn Marshall: Of course, that's not addressing any cost allocation or rate design issues, which is, you know, sort of on tap to be addressed in PUC proceedings.

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00:35:54.890 --> 00:36:03.120

Lynn Marshall: A couple of other, assumptions. So, we have a kind of a baseline general... general rate case spending level.

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00:36:03.520 --> 00:36:09.710

Lynn Marshall: Then on top of that, we have wildfire mitigation costs.

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00:36:10.150 --> 00:36:13.159

Lynn Marshall: It used to be that

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00:36:13.800 --> 00:36:26.380

Lynn Marshall: almost all of distribution costs were collected through the distribution revenue requirement. Now have... there's additional pathways for the utilities to collect revenue so they can get

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00:36:26.500 --> 00:36:38.330

Lynn Marshall: through their wildfire mitigation cost applications, both recovery for catastrophic events, but also wildfire mitigation spending that's

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00:36:38.630 --> 00:36:49.649

Lynn Marshall: above and beyond what is approved in the GRC, but that is consistent with their wildfire mitigation plan. We assume the current level of spending will continue.

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00:36:49.990 --> 00:36:54.630

Lynn Marshall: We're using the second quarter PUC

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00:36:54.730 --> 00:37:12.550

Lynn Marshall: tracking tool data, where the IOUs report all their current and pending revenue requirements, so that's very helpful. And then, as a reminder, the denominator for this is going to be last year's planning scenario, because this is an input into the forecast for this year.

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00:37:13.330 --> 00:37:22.859

Lynn Marshall: All right, so we can go on to the next slide, and I'm going to show first the planning area results.

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00:37:23.030 --> 00:37:27.639

Lynn Marshall: So, thank you. So these are...

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00:37:28.020 --> 00:37:41.839

Lynn Marshall: planning area, this is all LSEs in the PG&E area, so that includes CCAs, ESPs, the bundled customers, plus about 10% publicly owned utilities.

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00:37:42.880 --> 00:37:45.430

Lynn Marshall: So, what we can see here in...

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00:37:46.520 --> 00:37:59.700

Lynn Marshall: recent years, at the beginning of the forecast, we have seen a big drop in PG&E rates. They had a lot of cost recovery for catastrophic events, and those have been amortized, so we have seen rates come down a bit.

218

00:38:00.360 --> 00:38:01.640

Lynn Marshall: And in

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00:38:01.790 --> 00:38:07.529

Lynn Marshall: the near term, also contributing to the lower forecast is the

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00:38:07.630 --> 00:38:27.190

Lynn Marshall: planning forecast for last year for PG&E had a lot of load growth, like, through 2035, then load growth does slow. So that rapid load growth is helping to dilute the per kilowatt cost of things like transmission and distribution spending.

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00:38:27.290 --> 00:38:41.329

Lynn Marshall: Then as low growth slows later in the forecast, and the impact of those rising generation spending is seen in rates, right, we start to see real rates increase again.

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00:38:41.430 --> 00:38:49.040

Lynn Marshall: So we'll see a similar trend in the other planning areas. So let's go to SCE.

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00:38:50.410 --> 00:38:51.830

Lynn Marshall: Next slide, yeah.

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00:38:52.130 --> 00:38:56.600

Lynn Marshall: So, not, not as big of a change here,

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00:38:57.400 --> 00:39:13.080

Lynn Marshall: SCE didn't have the big run-up in, you know, cost impacts of catastrophic events. Those, they moved... those costs were more directly securitized, so they're being paid for by ratepayers, but it's like an annual, fixed annual payment with lower interest costs.

226

00:39:13.950 --> 00:39:29.339

Lynn Marshall: But also, in 2026 and 2027, in 2026, they've already started to settle claims from the Eaton Fire. That's assumed to continue somewhat. I think, ultimately, the costs of

227

00:39:29.380 --> 00:39:36.920

Lynn Marshall: the impacts of the Eaton Fire are unknown, but we did assume some continued impact from that.

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00:39:37.200 --> 00:39:44.670

Lynn Marshall: And then, again, longer term, the longer part of the forecast rates are going up because of higher generation costs.

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00:39:45.780 --> 00:39:54.660

Lynn Marshall: And then finally, next slide, for the IOUs is San Diego,.

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00:39:55.030 --> 00:40:00.239

Lynn Marshall: a little different situation from them.

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00:40:00.420 --> 00:40:12.969

Lynn Marshall: Although procurement prices are going down in 2026 and 2027, they actually had a big undercollection, from last year's generation rate, so they are having to collect that.

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00:40:13.170 --> 00:40:24.170

Lynn Marshall: In 2027, so customers are seeing a sizable rate increase there, and then they've just recently filed their 2028 general rate case, so

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00:40:24.330 --> 00:40:32.650

Lynn Marshall: the sector impacts there would be between 5% and 8%. I think the residential rate increases

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00:40:32.850 --> 00:40:37.040

Lynn Marshall: closer to, like, 7.5%,

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00:40:38.560 --> 00:40:48.179

Lynn Marshall: That's just recently filed. I don't have a good sense of where, like, interveners will come down on that, so the final adopted rates are likely to be a little lower.

236

00:40:48.780 --> 00:41:02.169

Lynn Marshall: All right, so those are the three, big IOU planning areas. Let's go to the next slide, and what I'm showing here is, in addition to the IOUs, we have the larger,

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00:41:03.100 --> 00:41:12.380

Lynn Marshall: other planning areas, where we're seeing... so there's some different trends here. Burbank and Glendale, are both facing large

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00:41:12.650 --> 00:41:24.119

Lynn Marshall: rate increases to implement projects like repowering the interstate power plant, repowering Grayson, upgrading transmission to support renewable impact. So

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00:41:24.120 --> 00:41:32.720

Lynn Marshall: after those rate increases are implemented over the next few years, it is likely that they would level off more consistent with

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00:41:32.810 --> 00:41:52.580

Lynn Marshall: inflation. The LADWP projection, this is actually LA's forecast that they filed with us last year. It's consistent with their LA100 plan, which is their very ambitious and wide-ranging kind of clean energy plan, lots of investment in DERs.

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00:41:52.710 --> 00:42:03.049

Lynn Marshall: The board actually has not initiated a formal rate action on that, so it's possible that they could... they could modify that outcome somewhat, so we'll have to see.

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00:42:03.330 --> 00:42:10.080

Lynn Marshall: And then Northern California, not CAISO, that's about 60% SMUD, who...

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00:42:10.490 --> 00:42:21.560

Lynn Marshall: continues to be able to, you know, move ahead on, you know, progress towards its clean energy goals at the 3% annual rate increase. We'll see if they're able to

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00:42:21.880 --> 00:42:34.159

Lynn Marshall: stick with that. And then the other, utilities in that area are actually a lot of irrigation districts, like Turlock and Merced, they have a lot of hydro. They're typically able to keep rates pretty low.

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00:42:35.330 --> 00:42:39.120

Lynn Marshall: So now we're gonna take all of the...

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00:42:39.430 --> 00:42:43.900

Lynn Marshall: planning areas and construct a statewide forecast. So, next slide.

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00:42:44.640 --> 00:42:57.270

Lynn Marshall: statewide rates by sector, and these are the weighted average of all the planning areas, and these are what the transportation models are currently using.

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00:42:57.680 --> 00:43:06.590

Lynn Marshall: And I... I'll just, sort of, in conclusion there, note it's nice that we're not seeing the rapid growth and increases that we have in

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00:43:07.270 --> 00:43:20.820

Lynn Marshall: recent years, real rates are increasing, like, 7 tenths of a percent over this forecast horizon, but for many customers, these rates are still far above where they were just a few years ago, so...

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00:43:22.620 --> 00:43:31.160

Lynn Marshall: Finally, let's go to the next slide. I want to highlight a few key uncertainties, wildfire management. Right now

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00:43:31.310 --> 00:43:42.970

Lynn Marshall: I think in PG&E, wildfire-related costs are, like, 19% of revenue requirements, something maybe around 14% in SCE in San Diego.

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00:43:43.730 --> 00:43:59.759

Lynn Marshall: The PUC and the participants in those rate... in rate cases put a lot of effort into scrutinizing the wildfire mitigation plans and the cost recovery applications. They made progress, actually, on things like

253

00:43:59.760 --> 00:44:12.449

Lynn Marshall: getting vegetation management costs under control. But fundamentally, we have a system where, with the current regulatory and legal environment, utilities are logically incentivized to spend to

254

00:44:12.770 --> 00:44:20.889

Lynn Marshall: zero risk of utility-ignited wildfires, with the limited tools in the utility tool basket.

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00:44:22.090 --> 00:44:27.560

Lynn Marshall: The California Earthquake Authority recently released their

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00:44:28.260 --> 00:44:40.550

Lynn Marshall: Natural Catastrophe Resiliency Plan, and that was at the request of the legislature. And that lays out a more holistic approach,

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00:44:42.430 --> 00:44:47.190

Lynn Marshall: Spelling out multiple paths, Am I still speaking?

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00:44:47.440 --> 00:44:49.510

Lynn Marshall: for

259

00:44:51.020 --> 00:45:07.209

Lynn Marshall: the state to better address its liability risk. There's a lot of options in there, a lot of trade-offs. There's no quick fix, but under the status quo, we could continue to expect

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00:45:07.850 --> 00:45:21.150

Lynn Marshall: ratepayers are going to be... keep paying wildfire mitigation costs in their bills, and we won't be more holistically addressing the harm and the scope of the damage that occurs from these events.

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00:45:22.440 --> 00:45:30.399

Lynn Marshall: Next, another point that comes up a lot in the IEPR workshops, especially when we're talking about data center load growth, we are

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00:45:30.950 --> 00:45:41.949

Lynn Marshall: Investing a lot in the transmission and distribution grid, but if the low growth doesn't materialize, customers are really going to feel that in their bills.

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00:45:42.720 --> 00:45:56.920

Lynn Marshall: And then finally, the... while we have good visibility on near-term transmission costs, longer-term, the build-out could be more expensive than what we're forecasting here, so we'll keep working on that topic.

264

00:45:57.180 --> 00:46:00.080

Lynn Marshall: And with that, I will

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00:46:00.840 --> 00:46:03.459

Lynn Marshall: Turn it back to take questions.

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00:46:04.320 --> 00:46:11.540

Sandra Nakagawa: Thank you so much, Len. We're gonna go to our dais. Rajinder did have to hop off, but Commissioner McAllister, I'll turn it over to you.

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00:46:11.770 --> 00:46:24.120

Commissioner Andrew McAllister: Great, thanks. Thanks, Lynn, good stuff, and maybe just a couple of questions, sort of order of magnitude, questions, you know, acknowledging all the uncertainty.

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00:46:24.330 --> 00:46:27.840

Commissioner Andrew McAllister: You did a good job of describing that.

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00:46:29.290 --> 00:46:42.090

Commissioner Andrew McAllister: I wonder a couple of developments, you know, in the power markets in California across the West. One is the, you know, sort of ongoing regionalization

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00:46:42.210 --> 00:46:48.080

Commissioner Andrew McAllister: Of energy markets, and kind of wondering if you could give us a sense of

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00:46:48.300 --> 00:46:53.379

Commissioner Andrew McAllister: You know, the potential impacts of that in terms of lowering wholesale

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00:46:53.560 --> 00:47:01.210

Commissioner Andrew McAllister: the wholesale component of energy, that's kind of at the margins. If there's some scenarios, you know, where it would make a greater

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00:47:01.520 --> 00:47:10.780

Commissioner Andrew McAllister: Or lesser impact on people's bills, just as that wholesale price kind of goes, you know, goes through down to people's actually retail bills.

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00:47:11.020 --> 00:47:11.720

Commissioner Andrew McAllister: Yeah.

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00:47:11.720 --> 00:47:28.589

Lynn Marshall: That's a really good question. I've thought about that. I haven't tried to quantify that, but, you know, in this forecast, right, the energy prices are pretty low, given the assumptions we're using, but yeah, there definitely should be a benefit there.

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00:47:28.660 --> 00:47:33.509

Lynn Marshall: I think to some extent, we're seeing some of that already from that.

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00:47:33.510 --> 00:47:34.670

Commissioner Andrew McAllister: That'd be interesting.

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00:47:34.670 --> 00:47:35.270

Lynn Marshall: Yeah.

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00:47:36.400 --> 00:47:41.490

Commissioner Andrew McAllister: Let's see, I guess, you know, the other...

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00:47:41.590 --> 00:47:48.619

Commissioner Andrew McAllister: The other thing, you know, we're trying to work... working really hard to enable is load flexibility and trying to sort of do more

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00:47:48.740 --> 00:47:55.360

Commissioner Andrew McAllister: with, lower capital investments, particularly... well, really in the distribution and the transition of grid. I think the bigger challenge

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00:47:55.570 --> 00:47:57.640

Commissioner Andrew McAllister: That may end up being a longer-term

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00:47:58.140 --> 00:48:08.060

Commissioner Andrew McAllister: Kind of execution is on the distribution level, really figuring out how to avoid investments, you know, by improving capacity factors and just optimizing it.

284

00:48:08.320 --> 00:48:15.529

Commissioner Andrew McAllister: the use of the grid. Any, you know, this is... maybe this is more of an SB100 kind of question,

285

00:48:15.980 --> 00:48:25.199

Commissioner Andrew McAllister: But in terms of just, scenarios for the CAPEX and how those filter down, we heard a little bit about that from utilities in the last session.

286

00:48:25.730 --> 00:48:30.490

Commissioner Andrew McAllister: A few weeks ago, but I'm wondering, just, does that kind of play in at all to your...

287

00:48:30.670 --> 00:48:31.950

Commissioner Andrew McAllister: Assessment.

288

00:48:36.900 --> 00:48:40.860

Lynn Marshall: Well, I think it's key to get some of the

289

00:48:41.350 --> 00:48:48.989

Lynn Marshall: reduce the distribution costs that go into rates. I mean, we're getting... the rates are getting dangerously high to really being an obstacle.

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00:48:49.090 --> 00:48:52.290

Lynn Marshall: So, to the extent that I think we can reduce those,

291

00:48:53.410 --> 00:49:02.469

Lynn Marshall: all of the... the wire's costs, that's going to be an asset. Otherwise, I think it's getting increasingly difficult

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00:49:03.350 --> 00:49:05.870

Lynn Marshall: given the fixed cost on the system.

293

00:49:06.180 --> 00:49:21.359

Commissioner Andrew McAllister: Yeah, yeah. Any, sort of notable evolution, on the rate-making side? Obviously, it's not our business at the Energy Commission, but I think that, you know, you're very much in touch with the PUC and the rate-making bodies at the POU's. Any sort of,

294

00:49:21.590 --> 00:49:27.899

Commissioner Andrew McAllister: There are a few proceedings that touch on rates, and I think they just opened an advanced rate-making proceeding over there at PUC.

295

00:49:28.000 --> 00:49:42.610

Lynn Marshall: Yeah, that proceeding's very ambitious. I don't think they've totally scoped out, but it is going to address a lot of important topics, like, you know, rate design for large loads, flexibility.

296

00:49:42.810 --> 00:49:50.719

Lynn Marshall: So, I think there's a lot of interest in being more creative there and promoting electrification-friendly rates.

297

00:49:50.910 --> 00:49:59.400

Commissioner Andrew McAllister: Yeah, great, and you'll be... obviously, you're doing this, but just for the folks that are tuned in, I think, having the Energy Commission and PUC really keep

298

00:49:59.780 --> 00:50:05.229

Commissioner Andrew McAllister: Cross-pollinated on where that all is going, and how that could potentially impact

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00:50:05.570 --> 00:50:11.030

Commissioner Andrew McAllister: Rates in terms of, you know, fixed versus variable, and just kind of how energy appears to people.

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00:50:11.220 --> 00:50:22.790

Commissioner Andrew McAllister: On their bills, that... that, I think for many of the other presentations we're going to hear today, you know, behavior is such a driver of a lot of these behind-the-meter load modifiers and adoption of technology

301

00:50:23.050 --> 00:50:29.639

Commissioner Andrew McAllister: Etc. That energy cost really does matter, and if fixed charges become a bigger deal, then...

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00:50:29.870 --> 00:50:37.459

Commissioner Andrew McAllister: You know, that potentially makes electrification more accessible, you know, debatable, but that seems like an area we really need to understand better.

303

00:50:39.920 --> 00:50:40.710

Commissioner Andrew McAllister: Great.

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00:50:40.840 --> 00:50:49.530

Commissioner Andrew McAllister: Well, I appreciate your laying the, the groundwork here, for the following presentations. I, I don't know, Qing... yeah, there, you got your hand up, there you go.

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00:50:49.530 --> 00:50:50.390

Qing Tian: Yeah.

306

00:50:51.570 --> 00:51:02.010

Qing Tian: Thank you, thank you, Commissioner. Yeah, just a quick one. I think this is also some sort of, like, a related to Commissioner McAllister's question on demand flex. I'm wondering...

307

00:51:02.010 --> 00:51:15.730

Qing Tian: Because, there are, like, several studies, have been done recently. One is, the DGen, analysis, you mentioned. And there's also, like, utility, EIS work.

308

00:51:15.770 --> 00:51:18.590

Qing Tian: I'm just wondering, like, you know, how does the...

309

00:51:18.700 --> 00:51:27.000

Qing Tian: the, the, you know, the 2025 DGen analysis, comparing to, the utility's, you know, EIS work.

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00:51:27.140 --> 00:51:29.169

Qing Tian: Do we see, like,

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00:51:29.290 --> 00:51:43.260

Qing Tian: convergency in terms of the, you know, the magnitude and the timing of the, you know, estimate on distribution upgrades? Or are there still, like, a significant difference in, you know, assumptions or results?

312

00:51:43.560 --> 00:51:45.060

Qing Tian: Anything you can comment on?

313

00:51:45.060 --> 00:52:01.879

Lynn Marshall: Yeah, well, the... okay, the EIS2 studies by the IOUs did kind of have different purposes, different scenarios. They actually did, some, more detailed modeling of secondary costs, which...

314

00:52:01.920 --> 00:52:15.020

Lynn Marshall: you know, admittedly, the public advocates, this is kind of a simple assumptions on that, but they all got dramatically different results. All three IOUs differ... used different approaches to secondary costs.

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00:52:15.020 --> 00:52:29.450

Lynn Marshall: I think Edison's was maybe pretty close to DGEM, the others were either higher or lower. So I think there's more work to be done on that, but I think really what those studies are about getting kind of directional

316

00:52:29.550 --> 00:52:41.389

Lynn Marshall: impacts and understanding, and I think that, IOUs studies were really looking at, you know, what are the strategies that work under certain scenarios, as opposed to...

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00:52:41.810 --> 00:52:43.300

Lynn Marshall: You know

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00:52:43.700 --> 00:52:51.280

Lynn Marshall: These aren't really trying to forecast, they are going to say, what are our options, and what, you know, what's... what's the most significant

319

00:52:51.830 --> 00:52:53.800

Lynn Marshall: variables at play.

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00:52:57.010 --> 00:52:57.719

Qing Tian: Thank you.

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00:53:01.980 --> 00:53:07.650

Commissioner Andrew McAllister: Great, well, thanks a lot, Lynn. I really appreciate your, your work, and

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00:53:08.200 --> 00:53:13.219

Commissioner Andrew McAllister: pass it back to Sandra, or maybe directly to, the next panel.

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00:53:13.260 --> 00:53:14.900

Sandra Nakagawa: Thank you so much, Lynn.

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00:53:14.900 --> 00:53:15.859

Commissioner Andrew McAllister: Oh, there is something.

325

00:53:16.150 --> 00:53:29.670

Sandra Nakagawa: Yeah, we're gonna now hear some updates on behind-the-meter solar and, battery storage, and how that's affecting the forecast. Bobby Wilson is a Distributed Generation Specialist, and he's gonna kick us off for this section. Thanks, Bobby!

326

00:53:30.980 --> 00:53:38.480

Bobby Wilson: Thank you, Sandra. Hello, everyone. Today, I will be presenting on historical behind-the-meter distributed generation insights.

327

00:53:38.660 --> 00:53:40.090

Bobby Wilson: Next slide, please.

328

00:53:41.400 --> 00:53:46.889

Bobby Wilson: Before we begin, here's a list of acronyms and initialisms that you might see or hear in my presentation.

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00:53:47.540 --> 00:53:48.620

Bobby Wilson: Next slide.

330

00:53:50.530 --> 00:54:04.979

Bobby Wilson: Okay, so historical behind-the-meter PV and storage capacity are important inputs for several models used to create the forecast. Behind-the-meter PV capacity is used to calculate behind-the-meter PV generation, which feeds into the hourly load and sector models.

331

00:54:05.010 --> 00:54:10.710

Bobby Wilson: And then PV and storage capacity are both used to establish market saturation in the DEGEN model.

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00:54:10.850 --> 00:54:13.520

Bobby Wilson: which forecasts adoption, PV adoption.

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00:54:14.380 --> 00:54:15.669

Bobby Wilson: Next slide, please.

334

00:54:17.410 --> 00:54:31.170

Bobby Wilson: Alright, an overview of our key findings here. These are spread across 4 bullet points, and they are going to be explored in the upcoming slides. So, the first is that we have observed the share of third-party-owned PV systems has doubled since 2023.

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00:54:31.830 --> 00:54:41.920

Bobby Wilson: And then our second observation is that application volume through quarter one of 2026 is similar to application volume in quarter one of 2025.

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00:54:42.000 --> 00:54:56.259

Bobby Wilson: And with regards to both of these points, the TPO systems and the volume of applications, we believe this may be due in part to the fact that ITC credits remain available through December 2027 for commercial installations.

337

00:54:56.380 --> 00:55:12.779

Bobby Wilson: And so we'll talk more about that on the upcoming slides. And then the last point here is that there were 2,000 megawatts of PV capacity and 1,600 megawatts of behind-the-meter storage capacity interconnected in 2025.

338

00:55:12.910 --> 00:55:18.000

Bobby Wilson: For storage capacity, that is nearly double the amount that was interconnected in 2024.

339

00:55:19.190 --> 00:55:21.219

Bobby Wilson: Okay, next slide, please.

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00:55:23.580 --> 00:55:35.359

Bobby Wilson: And on to PV adoption trends, thank you. Okay, a brief review of our methodology. The data integration branch at the CEC collects UDC interconnection data under Title 20.

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00:55:35.640 --> 00:55:48.869

Bobby Wilson: also referred to as 1304B data. And then we clean and aggregate that data, and we QC it against our previous estimates, as well as against DGStats, which is a publicly available website.

342

00:55:49.560 --> 00:55:50.789

Bobby Wilson: Next slide, please.

343

00:55:52.410 --> 00:55:59.130

Bobby Wilson: So, here's a look at that cleaned data. This is the statewide capacity at the end of calendar year 2025.

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00:55:59.310 --> 00:56:06.130

Bobby Wilson: There are 2.3 million systems, and over 20,000 megawatts of behind-the-meter PV capacity.

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00:56:06.400 --> 00:56:10.640

Bobby Wilson: Our estimates this year have been refined after improved data reporting.

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00:56:12.250 --> 00:56:13.639

Bobby Wilson: Next slide, please.

347

00:56:14.400 --> 00:56:25.060

Bobby Wilson: And then here's a breakout of the PV capacity in the CAISO transmission area. 1800 megawatts of BTM PV capacity was added to the CAISO transmission area in 2025.

348

00:56:27.210 --> 00:56:28.710

Bobby Wilson: Okay, next slide.

349

00:56:29.930 --> 00:56:37.100

Bobby Wilson: For the next several slides, we leverage DGStat's publicly available application data, as well as their pending application data.

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00:56:37.200 --> 00:56:57.010

Bobby Wilson: This first slide is a look at residential PV system sizes. We looked at systems between 0 and 15 kilowatts, and we found that the median system size has grown from 5.2 kilowatts in 2019 to 5.7 kilowatts in 2025. And the range of system sizes has also increased in that time frame.

351

00:56:58.870 --> 00:57:00.550

Bobby Wilson: Okay, next slide, please.

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00:57:01.820 --> 00:57:07.290

Bobby Wilson: This chart shows the percentage of systems that are third-party owned in IOU service territory.

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00:57:07.640 --> 00:57:15.780

Bobby Wilson: The data used to make this chart comes from DGStat's interconnected and pending application data, so some of these systems are not interconnected.

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00:57:16.390 --> 00:57:17.720

Bobby Wilson: But the majority are.

355

00:57:17.990 --> 00:57:26.240

Bobby Wilson: Additionally, we did not create a breakout for systems that are paired with storage, so this includes any residential PV system with or without paired storage.

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00:57:26.630 --> 00:57:32.320

Bobby Wilson: As you can see, starting in 2024, there is a sharp increase in the share of TPO systems.

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00:57:32.620 --> 00:57:41.700

Bobby Wilson: For the last 2 full calendar years, as well as through the first 5 months of this year, the share of PV systems that are third-party owned has hovered around 50%.

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00:57:41.920 --> 00:57:48.659

Bobby Wilson: And overall, this represents a 16% increase in share of TPO systems from 2021 to 2026.

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00:57:49.120 --> 00:58:05.920

Bobby Wilson: As we mentioned in the beginning, the rise in TPO share might be attributed to the fact that ITC tax credits are still available for commercial systems, so a residential customer can enter an agreement with a third-party owner and still get the benefit of a tax credit claimed through the commercial entity.

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00:58:07.920 --> 00:58:09.600

Bobby Wilson: Okay, next slide, please.

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00:58:10.720 --> 00:58:25.960

Bobby Wilson: This chart shows the monthly application volume for the calendar years 2021 through 2026. We have omitted calendar year 2023, because the sunset of NEM 2.0 caused a one-time surge in application volume, so it's an outlier.

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00:58:26.040 --> 00:58:33.619

Bobby Wilson: There's also a little mistake here on this chart. That bottom line, the orange line, 2022, that's actually 2024.

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00:58:34.110 --> 00:58:43.170

Bobby Wilson: So, this chart was also made using DGStat's application data, so it only includes PG&E, SCE, and SDG&E service territories.

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00:58:43.490 --> 00:58:49.420

Bobby Wilson: The dark blue line shows the application volume for the first 4 months of 2026.

365

00:58:49.820 --> 00:58:56.769

Bobby Wilson: The volume is consistent with application volume for Quarter 1, 2024, and 2025.

366

00:58:57.160 --> 00:59:05.400

Bobby Wilson: So, the average capacity requested in applications for Q1 2025 was 163 megawatts.

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00:59:05.760 --> 00:59:20.870

Bobby Wilson: For 2026, it's 147 megawatts. But if we extend one more month, so if we look at the first 4 months of 2025 and the first 4 months of 2026, the average capacity requested is 160 megawatts for both years.

368

00:59:21.310 --> 00:59:37.500

Bobby Wilson: So, in conclusion, the anticipated reduction in application volume has not materialized, and as we said before, that might be due to the ITC tax credit remaining available for commercial systems until December 2027, the same thing that is pushing TPO share.

369

00:59:39.210 --> 00:59:40.479

Bobby Wilson: Next slide, please.

370

00:59:42.210 --> 00:59:44.369

Bobby Wilson: Alright, on to storage trends.

371

00:59:44.560 --> 00:59:46.390

Bobby Wilson: Next slide, thank you.

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00:59:46.540 --> 01:00:00.370

Bobby Wilson: So 2025 saw a large increase in interconnected storage capacity. 1,600 megawatts of storage capacity was interconnected in 2025, and 1,500 megawatts of that storage capacity was residential.

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01:00:00.700 --> 01:00:07.339

Bobby Wilson: And so, since the end of calendar year 2022, the amount of BTM storage capacity has more than tripled.

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01:00:09.560 --> 01:00:11.230

Bobby Wilson: Okay, next slide.

375

01:00:12.410 --> 01:00:21.610

Bobby Wilson: And finally, here is a look at the storage capacity in the CAISO transmission area, which makes up the majority of BTM storage capacity in the state.

376

01:00:24.570 --> 01:00:37.610

Bobby Wilson: Okay, next slide. That's the end of my presentation. A quick thank you to the Demand Forecasting Unit and the Data Integration Branch at the CEC, as well as the DG Stats team. And with that, I will pass it on to Mark Palmere.

377

01:00:48.830 --> 01:00:51.080

Mark Palmere: Good morning, active participants.

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01:00:51.340 --> 01:01:05.340

Mark Palmere: My name is Mark Palmere, and I am the Distributed Generation Adoption Lead at CEC. Today, I'll be talking about the inputs and assumptions for the distributed generation scenarios as part of the overall IEPR forecast for 2026.

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01:01:05.560 --> 01:01:06.840

Mark Palmere: Slide, please.

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01:01:08.340 --> 01:01:14.740

Mark Palmere: Before we get into details, here is a list of acronyms and initialisms I'll be using in this presentation.

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01:01:14.950 --> 01:01:16.130

Mark Palmere: Slide, please.

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01:01:17.300 --> 01:01:33.979

Mark Palmere: I'd like to begin by looking at the forecast framing. As part of the distributed generation forecast, we consider the following behind-the-meter technologies: Solar PV, energy storage, and other generations such as fuel cell combined heat and power, gas turbine, and wind turbine.

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01:01:34.080 --> 01:01:39.249

Mark Palmere: The metrics that we measure are capacity and energy. Next slide, please.

384

01:01:40.930 --> 01:01:55.620

Mark Palmere: There are two types of adoption forecasts we use, economics-based, which considers the economics of customers choosing to adopt DG technologies, and compliance-based, which considers the standards set by Title 24 requirements.

385

01:01:56.540 --> 01:01:57.670

Mark Palmere: Next slide, please.

386

01:01:59.070 --> 01:02:05.669

Mark Palmere: Here is a closer look at our modeling architecture, and how specifically the inputs affect each section of our forecast.

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01:02:06.140 --> 01:02:25.839

Mark Palmere: to the historical calculations, the compliance-based adoption forecast, and the economics-based forecast. The historical adoption feeds into the economics-based adoption forecasts, and the compliance-based forecast is calculated separately, but all of that leads to the overall behind-the-meter

388

01:02:26.230 --> 01:02:29.170

Mark Palmere: Distributed generation adoption forecast.

389

01:02:29.320 --> 01:02:30.450

Mark Palmere: Next slide, please.

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01:02:32.510 --> 01:02:49.109

Mark Palmere: Here are scenarios we'll be using this year. Please note that we have not made any scenario changes from last year's forecast, as we still believe they rep... as we believe they still rep... they still best represent the, possible scenarios. Next slide, please.

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01:02:50.750 --> 01:02:54.339

Mark Palmere: Now I'll move on to updates to this year's forecast.

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01:02:54.680 --> 01:03:12.200

Mark Palmere: First, we have updated historical technology costs through our base year, which is 2025, using data from the DGStats website. Here is a look at the residential PV historical cost curve, and as you can see, costs have dropped dramatically in the past few years.

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01:03:12.410 --> 01:03:27.890

Mark Palmere: We can't attribute this to one specific factor, but we believe a combination of technological advancements and better information for customers has contributed to this change we're seeing, this trend.

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01:03:28.500 --> 01:03:29.649

Mark Palmere: Next slide.

395

01:03:31.030 --> 01:03:42.360

Mark Palmere: This leads into our forecast costs. For both PV and storage, we use the National Laboratory of the Rockies' annual technology baseline to calculate future costs.

396

01:03:42.600 --> 01:03:56.910

Mark Palmere: This graph shows the residential PV specifics. So the annual cost reduction is about 10 cents per watt through 2035, and then 4 cents per watt after that, as it begins... as it starts leveling off just a bit.

397

01:03:57.140 --> 01:04:05.049

Mark Palmere: So what this means for the forecast is that we expect the mid-case to see PV,

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01:04:05.190 --> 01:04:14.530

Mark Palmere: PV costing less than \$2 per watt by the end of the forecast. For this forecast, we're ending at 2045, as a reminder.

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01:04:15.410 --> 01:04:16.940

Mark Palmere: Next slide, please.

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01:04:18.380 --> 01:04:35.860

Mark Palmere: We have also revised our housing completions forecast downward based on the latest data. We're forecasting 800,000 fewer homes by 2045, and so that's attributed to the lower growth rate in households forecast by the Department of Finance.

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01:04:35.940 --> 01:04:46.859

Mark Palmere: And this downward adjustment is relevant to our forecast because it will lead to fewer Title 24 PV installations being forecast in the upcoming IEPR.

402

01:04:47.720 --> 01:04:49.310

Mark Palmere: Next slide, please.

403

01:04:51.090 --> 01:05:07.919

Mark Palmere: We are also monitoring the policy landscape and incorporating changes where necessary. The removal of the ITC for residential-owned PV after 2025 was extensively covered last year and did lead to a lower PV and storage adoption forecast.

404

01:05:07.990 --> 01:05:20.559

Mark Palmere: Since then, Congress has introduced multiple bills that would reinstate the ITC, and while none are expected to pass, it does indicate policymakers do have an interest in reviving the ITC.

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01:05:20.760 --> 01:05:39.240

Mark Palmere: So at the state level, there is a bill that we're monitoring that would streamline approvals for plug-in solar, thus allowing renters and multifamily households to reduce their energy bills without having to install rooftop solar. The latest,

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01:05:39.740 --> 01:05:46.050

Mark Palmere: Latest update to that, to that bill is that it has, been passed by the,

407

01:05:46.290 --> 01:06:05.760

Mark Palmere: Assembly and the Senate, so we're waiting for final word of potential, it being signed into law, but as of now, it's not a current part of the IEPR forecast, because

nothing is official, but it's something that we're going to continue to monitor, moving forward.

408

01:06:06.730 --> 01:06:08.250

Mark Palmere: Next slide, please.

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01:06:10.540 --> 01:06:18.250

Mark Palmere: Finally, I'd like to share some model enhancements that we inspect... that we expect to incorporate into future forecasts.

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01:06:18.390 --> 01:06:33.880

Mark Palmere: We recently executed a contract with Verdant Associates LLC to improve the capabilities of DGen, these improvements being specific to the economics-based retrofit adoption forecast, which is what the dGen model covers.

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01:06:33.940 --> 01:06:44.859

Mark Palmere: Planned improvements include dGen agent refinement by using interval meter data to enhance representation of diverse electricity customers.

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01:06:45.890 --> 01:06:57.299

Mark Palmere: A market dynamics assessment that will assess the effectiveness of parameters to determine adoption rates within the model, including bass diffusion coefficients and maximum market shares.

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01:06:57.810 --> 01:07:13.659

Mark Palmere: Also, there will be an enabling of modeling of leased versus customer-owned systems, which staff would like to incorporate in response to data that was just shared by Bobby, showing notable increases in third-party owned installations.

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01:07:15.280 --> 01:07:23.700

Mark Palmere: We are also planning technology cost refinements, which would capture regional diversity in behind-the-meter PV and energy storage costs.

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01:07:23.960 --> 01:07:33.819

Mark Palmere: As well as, finally, improved storage attachment rate predictions, which we intend to have to reflect observed data more accurately.

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01:07:34.680 --> 01:07:36.370

Mark Palmere: Next slide, please.

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01:07:38.920 --> 01:07:50.820

Mark Palmere: So this concludes my presentation. Thank you all for listening. I think we'll now turn it over to the dais for any questions or comments.

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01:07:52.070 --> 01:07:59.300

Commissioner Andrew McAllister: Great. Well, thanks, Bobby, and thanks, Mark. Really appreciate you both, and

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01:07:59.770 --> 01:08:09.460

Commissioner Andrew McAllister: Yeah, let's see, let's, let's see, I think, Qing is still with us, so, I'll... actually, do you want to ask any questions first, Qing, or I'm happy to go, I've got a couple.

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01:08:10.800 --> 01:08:21.029

Qing Tian: Yeah, I have a few. I think you might be... this might... it might be some question you're also interested. I think this is one for... for Bobby,

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01:08:21.180 --> 01:08:28.250

Qing Tian: Just curious, like, do we have, ability to distinguish, like, how much of the...

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01:08:28.540 --> 01:08:34.270

Qing Tian: Recent PV storage growth is, associated with, the new construction.

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01:08:34.640 --> 01:08:39.229

Qing Tian: You know, versus, like, installation of the existing buildings.

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01:08:39.529 --> 01:08:46.010

Qing Tian: you know, given the, you know, the building, codes requirement.

425

01:08:46.260 --> 01:08:56.659

Qing Tian: And do you think, you know, tracking those, like, separately will help improve our understanding of the adoption trends? So anything you can comment on that?

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01:08:57.109 --> 01:09:06.329

Bobby Wilson: Yeah, absolutely. It would definitely, improve our understanding of the adoption trends and the forecasting. We're working on that. We currently do not have any data on it.

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01:09:06.439 --> 01:09:17.569

Bobby Wilson: There's no way in the 1304B data, which is collected by the CEC, to find out which, PV systems are interconnected because of,

428

01:09:18.029 --> 01:09:22.689

Bobby Wilson: Title 24, but, we're trying to come up with some different

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01:09:22.979 --> 01:09:25.899

Bobby Wilson: Ways to perhaps do that, and we're...

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01:09:26.039 --> 01:09:31.299

Bobby Wilson: We looked into it earlier this year, but yeah, as of right now, we don't have it, but that's definitely something we're working on.

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01:09:32.459 --> 01:09:42.959

Commissioner Andrew McAllister: Actually, can I ask a follow-up there? So, do... so the... we used to have the curb data, right? Which was essentially the builders would tell us, I think, or at least they had a database that they maintained.

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01:09:43.309 --> 01:09:51.899

Commissioner Andrew McAllister: About a lot of different issues, a lot of different metrics, but I think that data is no longer accessible,

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01:09:52.109 --> 01:09:59.849

Commissioner Andrew McAllister: The efficiency division has been keeping good track of that. We're trying to look for alternatives for, you know, reasons in Title 24 land.

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01:10:00.339 --> 01:10:03.549

Commissioner Andrew McAllister: But I would have thought that there would be a good...

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01:10:03.709 --> 01:10:07.689

Commissioner Andrew McAllister: You know, source of just housing starts and housing completions.

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01:10:07.869 --> 01:10:13.689

Commissioner Andrew McAllister: Just kind of as a matter of course, and some assumptions there about the average size, you know.

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01:10:13.999 --> 01:10:18.059

Commissioner Andrew McAllister: Her house as, you know, minimum code requirement. Seems like we could get pretty close.

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01:10:19.270 --> 01:10:34.160

Bobby Wilson: Yeah, with the curve data, that predates me. I have never used the curve data. As far as housing starts and housing completions, I mean, we do make some assumptions in order to try to figure out how much of this is compliance-based.

439

01:10:34.390 --> 01:10:39.750

Bobby Wilson: But, we were trying to do a more extensive, actual project-to-project.

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01:10:39.750 --> 01:10:40.840

Commissioner Andrew McAllister: Match them.

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01:10:40.930 --> 01:10:48.070

Bobby Wilson: And so we've reached out to some other agencies that have datasets that could possibly have a common

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01:10:48.220 --> 01:10:52.640

Bobby Wilson: Common entries, but yeah, so far we haven't been able to do that analysis.

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01:10:52.640 --> 01:11:01.939

Commissioner Andrew McAllister: Well, I would suggest maybe talking to the Title 24 team, Will and Gypsy, and that team, because, you know, through them, maybe ping the...

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01:11:02.310 --> 01:11:09.450

Commissioner Andrew McAllister: the, the CBIA, the California Building Industries Association, because I think they, they'd probably be willing to share

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01:11:10.720 --> 01:11:16.470

Commissioner Andrew McAllister: those kinds of numbers. I think they're, you know, they're... one point of pride is how many, you know, that they're...

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01:11:16.590 --> 01:11:20.640

Commissioner Andrew McAllister: They're offering PV on every new start... on every new, single-family home.

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01:11:20.930 --> 01:11:30.369

Commissioner Andrew McAllister: And then multifamily also has a requirement. Maybe that's a little tougher, but the, you know, the business properties or the Multifamily Housing Association might also be able to offer some good data.

448

01:11:31.490 --> 01:11:32.030

Bobby Wilson: Okay.

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01:11:33.660 --> 01:11:34.720

Commissioner Andrew McAllister: Yeah.

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01:11:34.720 --> 01:11:41.910

Qing Tian: Thank you, yeah, thank you, Commissioner. My next question is more about the behind-the-meter batteries.

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01:11:42.010 --> 01:11:49.259

Qing Tian: You know, your presentation clearly showed, like, there's a significant behind-the-meter battery storage, last couple of years.

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01:11:49.420 --> 01:11:58.239

Qing Tian: How much do we actually, know about, like, Windows battery, like, charge discharge, like, during, like, daily operation?

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01:11:58.410 --> 01:12:04.230

Qing Tian: Are we, like, is, like, a nameplate capacity enough for the forecasting purpose, or...

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01:12:04.670 --> 01:12:13.180

Qing Tian: Do you think, like, we need some, like, better data, just to help us to understand, like, you know, how that might impact

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01:12:13.330 --> 01:12:16.290

Qing Tian: You know, the system overall, so...

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01:12:17.330 --> 01:12:27.169

Qing Tian: I don't know, feel free, Bobby, Mark, feel free to... I think this might be, like... Mark, I think this might be also, you know, relevant to your, presentation also, yeah.

457

01:12:28.430 --> 01:12:41.450

Bobby Wilson: Well, yeah, I can answer a little bit. Yeah, do we know how these, batteries are operating, charge and discharging? We have some data that we use to develop, load profiles, or excuse me, charge-discharge profiles for storage.

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01:12:41.620 --> 01:12:44.140

Bobby Wilson: But we're working on procuring more data.

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01:12:44.440 --> 01:12:49.190

Bobby Wilson: And, yeah, that's... that's, but...

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01:12:49.800 --> 01:12:53.719

Bobby Wilson: do we have, like, the amount of data we have for, say, PV, for the...

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01:12:53.830 --> 01:12:55.939

Bobby Wilson: storage and batteries, we don't.

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01:12:56.070 --> 01:12:57.369

Bobby Wilson: So...

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01:12:57.710 --> 01:13:03.380

Bobby Wilson: We've made, you know, and that's something that we present on in a different, in different workshops, but yeah,

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01:13:03.680 --> 01:13:08.419

Bobby Wilson: We're looking to get more data on it. We have made some assumptions with some... with the data that we do have.

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01:13:08.640 --> 01:13:14.449

Bobby Wilson: And that's what... that's how we've approached it thus far. But yes, we would love to have more data.

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01:13:20.200 --> 01:13:24.180

Commissioner Andrew McAllister: One other... sorry to be the peanut gallery here.

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01:13:24.720 --> 01:13:32.919

Commissioner Andrew McAllister: But, there... that's another meaningful distinction, I think, between the new construction and the existing buildings.

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01:13:33.250 --> 01:13:43.069

Commissioner Andrew McAllister: Because new construction, actually, batteries, to the extent that they are installed, they're not required in single-family, but to the extent that there are high attachment rates.

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01:13:43.540 --> 01:13:48.329

Commissioner Andrew McAllister: Or just some attachment for batteries to new construction PV.

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01:13:48.610 --> 01:13:56.710

Commissioner Andrew McAllister: The builders kind of... I think they're tending to like that. They feel like their customer wants it, and so they're installing increasingly batteries alongside the required PV.

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01:13:56.960 --> 01:14:03.530

Commissioner Andrew McAllister: And so, that battery in new construction is subject to a joint appendix,

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01:14:03.840 --> 01:14:15.889

Commissioner Andrew McAllister: dispatch regime. So, as part of the building code, going in, that battery has to, be, grid responsive in certain ways, and so I think

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01:14:15.970 --> 01:14:35.370

Commissioner Andrew McAllister: that's different from, you know, just an existing building that gets a PV Plus battery that kind of doesn't have any sort of governing, you know, dispatch regime. Now, to the extent that that is actually complied with, you know, down the road, once the family moves in or whatever, is an open question. But going in, there's a, you know, joint appendix that covers that within Title 24, so...

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01:14:35.520 --> 01:14:38.139

Commissioner Andrew McAllister: Maybe that can help with some assumptions as well.

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01:14:40.900 --> 01:14:41.690

Commissioner Andrew McAllister: Yep.

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01:14:41.690 --> 01:14:44.899

Qing Tian: Thank you, Commissioner. I don't have any questions.

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01:14:44.900 --> 01:14:52.140

Commissioner Andrew McAllister: Great. Thanks a lot, Chandler. I appreciate you kind of... we're doing a mind meld here. I had similar questions. I did want to ask,

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01:14:52.320 --> 01:15:00.620

Commissioner Andrew McAllister: Let's see... So, Bobby, you mentioned the driver of,

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01:15:00.900 --> 01:15:17.370

Commissioner Andrew McAllister: the third-party model as likely being related to tax credit persisting in the commercial and not in the residential, so that makes a lot of sense. Wonder, was there also... and you omitted, I think it was 2024? Or no, 2023?

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01:15:17.370 --> 01:15:18.390

Bobby Wilson: 2023.

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01:15:18.390 --> 01:15:22.460

Commissioner Andrew McAllister: other three. You omitted that one, which... which was, you know, the rush to the...

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01:15:22.670 --> 01:15:27.740

Commissioner Andrew McAllister: pre-MBT, you know, NEM2, expiration.

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01:15:28.170 --> 01:15:48.120

Commissioner Andrew McAllister: the... do you think that NBT also might favor, along with the tax credits, also, like, has a... maybe those two things combine? I'm thinking NBT, if the sort of benefit margin is narrower, then maybe that militates people to go over and look for some financing, rather than accept kind of a longer

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01:15:48.320 --> 01:15:49.700

Commissioner Andrew McAllister: payback.

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01:15:50.640 --> 01:16:02.329

Bobby Wilson: That's possible. I haven't read anything that suggests that, but Mark, I know you were also looking into what's driving the increase in TPO share. Did you run across anything that mentioned NBT?

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01:16:03.860 --> 01:16:07.329

Mark Palmere: Not, not specifically, no, but...

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01:16:07.330 --> 01:16:09.300

Commissioner Andrew McAllister: Okay, it seems like from both your presentations, you were...

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01:16:09.300 --> 01:16:09.690

Mark Palmere: I'm sorry.

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01:16:09.690 --> 01:16:16.380

Commissioner Andrew McAllister: the new normal, like, maybe half of the pre... half of the pre-NBT, you know, volume is sort of the new normal, seems like.

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01:16:17.170 --> 01:16:22.379

Commissioner Andrew McAllister: Roughly. So, I really appreciate all that data and synthesizing it as you did.

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01:16:22.960 --> 01:16:36.239

Commissioner Andrew McAllister: Mark, I'd love to see the, prediction, you know, \$2 PV by 2045. I guess I'm wondering, and it's great to see from, you know, high fours down into the 3s, like, over the last few years, you know, dollars per watt.

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01:16:36.420 --> 01:16:38.719

Commissioner Andrew McAllister: Which is great, I guess,

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01:16:38.960 --> 01:16:47.059

Commissioner Andrew McAllister: it still makes me wonder, I mean, you know, places like Australia, you've got installed costs, you know, well under a dollar per watt.

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01:16:47.230 --> 01:16:49.329

Commissioner Andrew McAllister: Today, you know? And...

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01:16:49.440 --> 01:16:59.000

Commissioner Andrew McAllister: Any sense of, sort of, what is driving these persistent high costs in California? I think that's basically the case in the U.S. generally.

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01:17:01.010 --> 01:17:06.630

Mark Palmere: Yeah, I think it's kind of a combination of factors.

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01:17:06.820 --> 01:17:10.029

Mark Palmere: I mean, I think the... I guess.

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01:17:10.280 --> 01:17:15.720

Mark Palmere: The simple answer would just be, like, we do have a different supply chain here than.

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01:17:16.310 --> 01:17:23.249

Mark Palmere: than in Australia, so there's some, like, different factors for,

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01:17:23.370 --> 01:17:31.510

Mark Palmere: For folks to deal with, like the manufacturers getting some of the, getting some of the raw materials that they need.

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01:17:32.690 --> 01:17:43.859

Mark Palmere: But, yeah, I mean, I think that's... I think that's a good point that, that there are places where solar is a lot cheaper, and, that,

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01:17:44.230 --> 01:17:49.640

Mark Palmere: Definitely kind of puts some confidence in our,

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01:17:51.300 --> 01:18:02.889

Mark Palmere: forecast, like, our belief that it will get lower. And I do think, like, tariffs, not... not, like, the current administration's tariffs, but, like, other tariffs that have been around for a while.

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01:18:02.890 --> 01:18:18.279

Mark Palmere: some of the smaller ones do, they can kind of add up, because a lot... I mean, it's interesting that a lot... that the U.S. as a whole has, like, the ability to manufacture enough, like, solar panels to meet demand, like.

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01:18:18.330 --> 01:18:32.630

Mark Palmere: within the, like, nationally, without any imports, but there's all... well, at least for now, there's still, like, a need to import some, like, raw materials and things like that, so it's still... importing still have an effect,

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01:18:32.660 --> 01:18:33.580

Commissioner Andrew McAllister: Even.

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01:18:33.580 --> 01:18:39.579

Mark Palmere: Even as manufacturing increases, which is definitely, like, a positive trend, but that's still going to be there.

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01:18:39.930 --> 01:18:42.819

Commissioner Andrew McAllister: So, like, you hear this soft cost term, right? And,

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01:18:43.500 --> 01:18:49.670

Commissioner Andrew McAllister: You know, that sort of is a catch-all, but it'd be really nice to kind of unpack that and see, you know, what the components are.

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01:18:50.070 --> 01:18:53.989

Commissioner Andrew McAllister: And I also wonder whether NBT,

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01:18:54.560 --> 01:18:57.539

Commissioner Andrew McAllister: Has kind of forced, a little bit of...

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01:18:57.640 --> 01:18:59.900

Commissioner Andrew McAllister: Discipline into that market as well.

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01:19:00.160 --> 01:19:05.439

Commissioner Andrew McAllister: Just with, you know, thinner margins kind of forcing prices down and a little bit more competition.

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01:19:05.880 --> 01:19:12.259

Commissioner Andrew McAllister: So I don't know if any listeners want to throw some comments on that, but it'd be interesting to understand that market dynamic.

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01:19:12.480 --> 01:19:23.940

Commissioner Andrew McAllister: Let's see, I'm also wondering... I see Lynn is still on, and there was a question I meant to ask her that I... that I... that slipped my mind there, so that my note-taking wasn't fast enough.

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01:19:24.260 --> 01:19:28.140

Commissioner Andrew McAllister: But, Lynn, if you're still on, can you... there you go.

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01:19:28.900 --> 01:19:29.340

Lynn Marshall: Yes.

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01:19:29.340 --> 01:19:34.489

Commissioner Andrew McAllister: Yeah, there she is, hey, hey, thanks for, thanks for, hanging on with us,

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01:19:34.930 --> 01:19:45.090

Commissioner Andrew McAllister: Let's... I wonder... so, you know, last week, last week, week before, there was news about, the... a potential policy in a new administration.

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01:19:45.430 --> 01:19:48.870

Commissioner Andrew McAllister: On the ag side, and...

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01:19:49.040 --> 01:19:53.459

Commissioner Andrew McAllister: Yeah, I saw... I meant, I saw that, you know, you had a square about, sort of, ag

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01:19:53.640 --> 01:20:00.130

Commissioner Andrew McAllister: Load, you know, in your presentation. And the concept is a power hour where,

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01:20:00.560 --> 01:20:08.660

Commissioner Andrew McAllister: Well, actually, it wasn't specific to ag, it was sort of for everybody, but I'm sorry, but I know in other places, they've done, like, India, they've done it... they've done it focused on agriculture.

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01:20:09.040 --> 01:20:17.690

Commissioner Andrew McAllister: And, you know, basically free power at night kind of thing for pumping, say. And a version of that, you know, proposed for potential administration,

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01:20:18.040 --> 01:20:23.359

Commissioner Andrew McAllister: would... you know, essentially make the marginal cost of energy zero.

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01:20:24.150 --> 01:20:32.370

Commissioner Andrew McAllister: for one or two hours, or however many, obviously, need to be fleshed out, in reality. But I wonder, kind of, how you think about that in terms of

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01:20:32.790 --> 01:20:40.909

Commissioner Andrew McAllister: You know, shaping... Again, sort of as a really kind of blend instrument flexibility tool.

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01:20:41.150 --> 01:20:46.720

Commissioner Andrew McAllister: And how that might impact rates more generally. It's going to lower average costs, and how that might percolate through.

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01:20:47.420 --> 01:20:56.110

Lynn Marshall: Yeah, it really, you know, a lot of studies show it takes a lot to get people to shift their load, a zero price.

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01:20:56.140 --> 01:21:12.600

Lynn Marshall: might be enough to kind of get their attention beyond just what time of use rates do. But then not everybody has flexibility to shift that much load. If you have solar and storage, yeah, you can do that, you know, pretty much easier.

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01:21:14.460 --> 01:21:19.990

Lynn Marshall: So, there's probably some limits on that. And then, of course, the cuffs and... First...

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01:21:20.840 --> 01:21:23.970

Lynn Marshall: question that comes to my mind is, who pays for it?

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01:21:24.390 --> 01:21:28.600

Lynn Marshall: So you're not shifting costs to other ratepayers.

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01:21:29.420 --> 01:21:30.820

Lynn Marshall: Where does that money come from?

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01:21:31.420 --> 01:21:34.289

Commissioner Andrew McAllister: Yeah, so maybe we have to kind of wait till that actually takes shape to...

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01:21:34.290 --> 01:21:35.559

Lynn Marshall: I think it was not...

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01:21:35.560 --> 01:21:37.420

Commissioner Andrew McAllister: I'm asking you to speculate, so apologies.

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01:21:37.420 --> 01:21:39.220

Lynn Marshall: Not a lot of details there.

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01:21:39.440 --> 01:21:40.520

Lynn Marshall: Oh, yeah, huh?

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01:21:40.630 --> 01:21:42.710

Commissioner Andrew McAllister: Great, alright, well, thanks a lot, I appreciate that.

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01:21:43.000 --> 01:21:54.829

Quentin Gee: Oh, Commissioner McAllister, I just wanted... I appreciated your question there for Lynn. I just wanted to let you know that the Demand Scenarios project this year is looking at the potential for that sort of.

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01:21:54.830 --> 01:21:55.250

Commissioner Andrew McAllister: Oh, great.

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01:21:55.250 --> 01:21:56.849

Quentin Gee: shift that could emerge.

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01:21:56.850 --> 01:22:00.070

Commissioner Andrew McAllister: Oh, terrific. Yeah, that's a perfect topic for that, for that,

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01:22:00.310 --> 01:22:03.059

Commissioner Andrew McAllister: that project. Thanks. Appreciate that.

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01:22:03.730 --> 01:22:07.659

Commissioner Andrew McAllister: So maybe that makes its way, like, into an SB100 scenario eventually.

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01:22:09.580 --> 01:22:10.130

Quentin Gee: Yeah.

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01:22:10.130 --> 01:22:12.140

Commissioner Andrew McAllister: Yeah, great, okay, perfect.

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01:22:12.810 --> 01:22:17.150

Commissioner Andrew McAllister: Let's see, I wonder, has Rajinder been able to,

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01:22:17.750 --> 01:22:19.870

Sandra Nakagawa: I think Rajinder has popped off for the day.

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01:22:19.870 --> 01:22:22.439

Commissioner Andrew McAllister: Oh, okay, okay. Well, we appreciate her being here.

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01:22:22.850 --> 01:22:28.060

Commissioner Andrew McAllister: For as long as she could. Qing, anything else, occur to you to ask?

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01:22:28.060 --> 01:22:32.740

Qing Tian: I don't have any more questions. Thank you for checking.

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01:22:32.900 --> 01:22:36.499

Commissioner Andrew McAllister: Thanks, gentlemen, really appreciate all your work. Good stuff.

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01:22:37.310 --> 01:22:37.980

Bobby Wilson: Thank you.

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01:22:38.570 --> 01:22:39.250

Commissioner Andrew McAllister: Alright, back to you.

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01:22:39.250 --> 01:22:40.280

Mark Palmere: Thank you, question.

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01:22:40.680 --> 01:22:46.190

Sandra Nakagawa: Alrighty, thanks everyone. We're now going to transition over to the Transportation Energy Demand Update.

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01:22:46.340 --> 01:22:52.790

Sandra Nakagawa: Andre Freeman is a supervisor with our Transportation Electrification Forecasting Branch. Andre, over to you.

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01:22:59.800 --> 01:23:06.409

Andre Freeman: Great, well, good morning, everyone. Today, I'll be presenting a high-level overview of our transportation forecast models.

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01:23:06.410 --> 01:23:21.459

Andre Freeman: and talk through some of the major inputs that go into those models. Although I will not be doing a deep dive on all the information that builds into our various models, we are always happy to have follow-up conversations with those interested to do a little bit of a deeper dive on those topics. Next slide.

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01:23:23.360 --> 01:23:25.290

Andre Freeman: Next, next slide.

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01:23:26.140 --> 01:23:41.440

Andre Freeman: So, you know, we have our acronyms, much like the previous presenters have. I've included this list for those who wish to go back and review those slides, who might be new to some of this topic, but I do want to highlight the AATE definition here for folks that haven't heard it before.

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01:23:41.450 --> 01:24:00.219

Andre Freeman: This stands for Additional Achievable Transportation Electrification. We define this as a certain group of managed forecast scenario types that seek to effectively reflect the impact of policies across various scenarios which would otherwise be difficult to reflect solely in a demand-side vehicle choice model.

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01:24:00.500 --> 01:24:03.920

Andre Freeman: We'll talk about these in a little bit more detail later in the presentation.

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01:24:04.370 --> 01:24:05.330

Andre Freeman: And next.

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01:24:08.050 --> 01:24:13.319

Andre Freeman: So, the forecast acts as a predictive tool to help assess future transportation energy demand.

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01:24:13.320 --> 01:24:30.029

Andre Freeman: It's used by government agencies, utilities, fuel providers, and many others to help plan infrastructure development, adjust energy policies, and implement emission reduction strategies and other regulatory initiatives. In essence, it enables better preparation for the evolving needs of California.

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01:24:30.500 --> 01:24:37.480

Andre Freeman: One of the key purposes for the forecast serves as to inform a balanced approach to proactive planning for electrification.

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01:24:37.480 --> 01:24:59.959

Andre Freeman: As you can imagine, overestimating the growth of transportation electrification could lead to overdevelopment of infrastructure and associated costs. That could lead to affordability issues. And on the other side, underestimating the rate of growth could lead to delayed development of the much-needed infrastructure and help... and would enable, in turn, prevent California from being able to achieve its climate and public health goals.

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01:25:00.240 --> 01:25:19.090

Andre Freeman: So at the simplest level, the Transportation Energy Forecast achieves this by taking a pragmatic approach to determining how many vehicles of what type are out on the road, the types of fuel that they'll use, and how much they will travel, which all factor into the overall consumption of the various fuel types that are used by vehicles in California.

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01:25:19.330 --> 01:25:27.849

Andre Freeman: As you'll see in the next slide, we use a complex series of models and data sets to help inform transportation choices and how they'll evolve over time.

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01:25:28.170 --> 01:25:35.880

Andre Freeman: So, taking it down a level, this flowchart shows the interconnected web of data and models that are used for our forecasting process.

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01:25:35.880 --> 01:25:53.259

Andre Freeman: As you can imagine, tracking the rapidly evolving world of transportation technologies, assessing changes in consumer behavior, forecasting the ebbs and flows of transportation fuel prices, and applying economic and demographic indicators to our projections requires a lot of data gathering and analysis.

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01:25:53.650 --> 01:26:13.029

Andre Freeman: At the top of this graphic, you can see some of the main data sources that we use for the forecast. Using those and other information as inputs for our modeling, we're able to determine vehicle choice metrics and adoption patterns, and how they might change over time, as well as changes in demand for various modes of transportation, vehicle types, and what have you.

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01:26:13.560 --> 01:26:22.879

Andre Freeman: The resulting information allows us to determine the overall changes in future vehicle population and drive the demand for transportation fuel that these vehicles will run on.

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01:26:23.200 --> 01:26:24.160

Andre Freeman: Next slide.

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01:26:25.980 --> 01:26:32.910

Andre Freeman: So one of the key areas for the light duty sector that we get a lot of questions on is the vehicle choice modeling that we do.

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01:26:33.000 --> 01:26:49.960

Andre Freeman: So we first take a look at things like the available vehicle options and specific attributes for each one of those vehicle types, and then over the last few years, there's been a lot of change in model availability, and there will likely be more in the foreseeable future, so we'll continue to update these aspects of our models.

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01:26:50.440 --> 01:26:57.049

Andre Freeman: We also look at social and economic indicators, like those we discussed at the last IEPR Workshop, and how those play into vehicle choice.

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01:26:57.140 --> 01:27:16.949

Andre Freeman: We'll incorporate new... things like new vehicle purchase incentives, including the one-time allocation provided through the MyFirstZEV program, which is bolstering near-term sales. We'll also look at things like changing retail fuel prices, which alongside upfront vehicle costs, are major deciding factors in vehicle purchase decisions.

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01:27:17.520 --> 01:27:20.520

Andre Freeman: Our modeling also looks at changing consumer preferences.

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01:27:20.520 --> 01:27:42.109

Andre Freeman: One of the key areas that I want to highlight here is our work through the California Vehicle Survey, which we run every few years. The California Vehicle Survey, which was last conducted in 2024, with a subsequent report being published last year, is available on our website for any of the folks that are interested in seeing that. I encourage you to review it if you want to get a little bit of a deeper insight into what California vehicle purchase behavior might look like.

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01:27:42.880 --> 01:27:51.460

Andre Freeman: And there are also many other inputs that go into our light-duty vehicle modeling, and we'll have additional information available when we release the draft results in the coming months.

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01:27:51.910 --> 01:27:52.910

Andre Freeman: Next slide.

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01:27:55.680 --> 01:28:05.769

Andre Freeman: Okay, so for our on-road truck sector modeling, we have a greater focus on economic factors, like total cost of ownership, funding availability, and changing modeling availability.

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01:28:05.910 --> 01:28:23.620

Andre Freeman: The way these models flow, we capture the demand for truck miles using data sources like the Freight Analysis Framework data from the Federal Highway Administration, California statewide freight forecasts, and other data sources that provide insight into how much trucks are actually traveling throughout the state.

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01:28:24.290 --> 01:28:41.509

Andre Freeman: We then simulate the uptake of new truck stock to meet this demand, taking relative cost of ownership, similar to our light-duty vehicle forecasting, into consideration. We also get a lot of questions about this sector and the many changes that have happened over the last few years, especially on the regulatory side of things.

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01:28:41.510 --> 01:28:58.659

Andre Freeman: And we definitely want to acknowledge that there's a high level of uncertainty associated with these regulatory drivers that we try to reflect by having these,

you know, baseline forecasts and multiple AATE scenarios to show different growth rates, based on what regulatory or other policy drivers might have to show in the future.

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01:28:59.430 --> 01:29:00.369

Andre Freeman: Next slide.

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01:29:04.510 --> 01:29:18.950

Andre Freeman: So, as I mentioned before, we have a baseline forecast and what we call additional achievable transportation electrification scenarios. These scenarios that are what we reflect in the IEPR report, are used to explore a range of potential future energy demand impacts.

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01:29:18.950 --> 01:29:28.490

Andre Freeman: Particularly those related to things like transportation electrification, beyond what is included typically in a business-as-usual vehicle adoption climate.

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01:29:28.930 --> 01:29:41.680

Andre Freeman: These scenarios will help policymakers and stakeholders understand the potential impacts of different energy policies and market trends, which will allow for more robust planning and decision-making by the various entities that do that throughout the year.

594

01:29:42.140 --> 01:29:43.080

Andre Freeman: Next slide.

595

01:29:45.250 --> 01:29:58.100

Andre Freeman: So the AATE scenarios are built to reflect a variety of possibilities from implementation of state policies. We have some high-level descriptions of them here, but again, we'll get into more detail when we show our draft results in the coming months.

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01:29:58.100 --> 01:30:11.250

Andre Freeman: You know, these range from, again, a kind of a business-as-usual baseline function to reflect, differing growth rates across the light, medium, and heavy-duty sectors, which we try to break out separately for these various scenarios.

597

01:30:12.110 --> 01:30:13.120

Andre Freeman: Next slide.

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01:30:15.210 --> 01:30:25.330

Andre Freeman: So, for the 2026 IEPR, we plan on updating the series of AATE scenarios to reflect significant uncertainty prompted by the ongoing actions by the federal government.

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01:30:25.470 --> 01:30:39.000

Andre Freeman: We'll look at different growth rates across light, medium, and heavy-duty vehicles, with a focus on how we can continue a trajectory towards accelerating zero-

emission vehicle deployment and supporting the necessary charging infrastructure for things like electric vehicles.

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01:30:40.120 --> 01:30:50.349

Andre Freeman: Which of these scenarios should be used for the various IEPR forecast cases is one of the areas we're seeking feedback on, and expect additional discussion during the upcoming IEPR workshops as well.

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01:30:51.050 --> 01:31:05.249

Andre Freeman: Summarizing some of the updates that we'll make for this year's forecast, the forecast will utilize updated vehicle availability and attribute information for these various models. We'll also include the economic and demographic info, which I mentioned earlier.

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01:31:05.860 --> 01:31:16.810

Andre Freeman: We'll also utilize an updated vehicle stock and population that shows the recent changes in zero-emission vehicle sales and the population through the end of 2025.

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01:31:17.150 --> 01:31:26.459

Andre Freeman: We'll also be looking at making minor updates to our EV charging load shapes that reflect analysis of real-world meter data showing changes in charging behavior.

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01:31:26.910 --> 01:31:40.749

Andre Freeman: We'll also be utilizing the results from our 2024 California Vehicle Survey, which I mentioned earlier, again, to reflect the ever-evolving world of how consumers are looking at electric vehicles and how their purchase behavior is changing over time.

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01:31:41.530 --> 01:31:48.320

Andre Freeman: We'll also be integrating the latest incentive program information to determine prospective vehicle purchase costs.

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01:31:48.960 --> 01:32:02.749

Andre Freeman: But I always want to mention that due to the timing of the IEPR, ongoing certainty in, you know, certain areas on the regulatory side, maybe possible future incentive programs, we will have several caveats that go along with our draft results that we put out later this year.

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01:32:02.750 --> 01:32:13.219

Andre Freeman: We always want to continue to acknowledge that these aren't supposed to be treated like crystal balls, but really supposed to reflect, some of the inputs and assumptions that we lay out that go into each of these scenarios.

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01:32:14.810 --> 01:32:15.980

Andre Freeman: Next slide.

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01:32:17.690 --> 01:32:20.789

Andre Freeman: Okay, finally, looking forward to future forecasts.

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01:32:20.870 --> 01:32:33.480

Andre Freeman: We'll be focused primarily on some of the areas of uncertainty that I mentioned earlier. We'll continue to keep a close eye on the results of the upcoming election cycle and subsequent changes at the state and federal levels as far as those policies go.

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01:32:33.490 --> 01:32:48.650

Andre Freeman: We'll make... continue to make regular updates to load shapes and an evolving analysis of consumer behavior through that advanced meter infrastructure data analysis I mentioned earlier, which realistically will be a standard part of our forecast updates every year moving forward.

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01:32:49.410 --> 01:33:01.009

Andre Freeman: And as new regulatory actions and funding programs are proposed, we will determine how to best integrate those into future forecasts, especially working with the implementing agencies for those efforts.

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01:33:01.750 --> 01:33:13.109

Andre Freeman: We'll also continue to make changes in vehicle... or update changes in vehicle model availability. There's been a lot of back and forth with the vehicle manufacturers over the last few years.

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01:33:13.110 --> 01:33:23.789

Andre Freeman: About what models will be available and when. So, as we get more updated information on that, we always want to keep our models current with, you know, what those near-term options are looking like for consumers.

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01:33:24.620 --> 01:33:39.470

Andre Freeman: Similarly, as the petroleum sector continues to evolve, we'll look at the changing prices consumers should expect at the pump, and any other factors that might, you know, shift people from gasoline and diesel vehicles into more zero-emission options.

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01:33:40.000 --> 01:33:55.970

Andre Freeman: One of the other things that I know there's a high amount of interest in is the autonomous vehicle sector. So, as the sector continues to grow, we'll continue collecting information such as that that's being submitted to the Public Utilities Commission about the real-world activities of these vehicles.

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01:33:55.970 --> 01:34:12.550

Andre Freeman: And we'll also be looking at gathering, again, real-world data that helps us, really identify how this market will change over time, what modes of transport might it influence in the future, and we can update our models accordingly as we get a more, you know, data-driven approach to that developed.

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01:34:13.180 --> 01:34:27.009

Andre Freeman: Then finally, as with previous years, we'll continue to gather data to refine our approach to assigning energy demand to forecasting zone levels and lower levels of granularity. Again, as more of that data comes in, we can continue refining those estimates.

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01:34:27.920 --> 01:34:31.569

Andre Freeman: So with that, I'm more than happy to take any questions that folks might have.

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01:34:34.340 --> 01:34:40.810

Commissioner Andrew McAllister: Great. Thanks, Andre, that was terrific. I'm always impressed with just how much, how thoughtful,

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01:34:41.310 --> 01:34:48.760

Commissioner Andrew McAllister: the work that the staff is doing on all these fronts, really is. I did have a couple of questions.

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01:34:50.050 --> 01:34:54.719

Commissioner Andrew McAllister: Let's see, and Qing, I noticed you came on too, you have questions as well?

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01:34:56.130 --> 01:34:57.709

Qing Tian: Yeah, just a quick one.

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01:34:57.710 --> 01:34:58.230

Commissioner Andrew McAllister: Yeah, go for it.

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01:34:59.740 --> 01:35:05.129

Qing Tian: And so... So, when we, when we talk about uncertainty in

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01:35:05.430 --> 01:35:21.390

Qing Tian: you know, transportation forecast, we often focus on, you know, the number of the vehicles, like we expect. So, from the grade perspective, you know, when they charge, you know, where they charge can...

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01:35:21.580 --> 01:35:24.970

Qing Tian: The... was also as important,

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01:35:25.120 --> 01:35:36.010

Qing Tian: Just a quick question, like, how confident are we in those assumptions today, and where do you see, you know, the biggest uncertainty from the planning perspective?

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01:35:38.740 --> 01:35:53.619

Andre Freeman: The biggest uncertainty. That's a hard question to answer at this point. So I mean, I think the... just starting with the biggest uncertainty part, I mean, the biggest uncertainty and the biggest impact to the overall forecast is undoubtedly the regulatory area.

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01:35:53.650 --> 01:36:10.079

Andre Freeman: You know, there's been a lot of, again, back and forth, you know, whiplash with what's happening at the federal, state, and local level, as far as regulatory drivers go. Those will have the biggest impact on the overall number of vehicles, and subsequently the overall amount of energy demand associated with those vehicles.

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01:36:10.170 --> 01:36:18.399

Andre Freeman: So, I mean, that's kind of the most outstanding question, which, again, as it evolves over time, you know, we'll make sure that's reflected in our scenarios.

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01:36:18.440 --> 01:36:34.160

Andre Freeman: Example right now, I mean, the Air Resources Board has continued to, you know, host workshops, have, kind of pre-regulatory development efforts where they've been bringing people together to say, okay, here's where we are, here's where the market is, where might we go in the future?

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01:36:34.240 --> 01:36:53.449

Andre Freeman: they've talked through some very high-level conceptual aspects of what future light-duty regulations may look like, for example, but that's an evolving process, so we do have to kind of set a cutoff for the IEPR forecast at some point. It's usually right around this time of August or September, where we say, here's a snapshot,

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01:36:53.480 --> 01:36:59.490

Andre Freeman: Here's the various uncertainty out there, whether it be regulatory, petroleum fuel prices.

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01:36:59.540 --> 01:37:07.190

Andre Freeman: And, you know, people's reactions to that, and then acknowledge those other areas of certainty that we might see coming down the pipeline.

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01:37:07.840 --> 01:37:25.720

Andre Freeman: To get to the other part of your question, you know, relying on the... where people are charging, how much are they charging, so some of that is captured in some of those Load shape updates that I mentioned earlier. So that helps us really understand, not the hypothetical realm of what might happen, but what people are actually doing right now.

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01:37:25.720 --> 01:37:28.450

Andre Freeman: Whether it be residential charging activities.

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01:37:28.450 --> 01:37:42.930

Andre Freeman: or things like DC fast chargers out in the wild that people will be using. You know, we'll keep a close eye on that, and it's constantly evolving. That's one of the areas where we're definitely not only looking at that analysis of that meter data, but also working with the utilities to see.

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01:37:42.930 --> 01:37:51.419

Andre Freeman: You know, what they're seeing directly from their customers, as far as requests for future capacity, the justification for that capacity,

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01:37:51.520 --> 01:38:16.490

Andre Freeman: you know, you always have to look at, like, Tesla, are there new types of chargers coming out? They're going to be more or less efficient, or what are they seeing for their customers? So, that really is kind of just something that we'll need to continue updating every year as additional data becomes available to, you know, reduce the amount of uncertainty that there is there about where that's going in the future. But, I mean, as you know, you know, EV technology is rapidly developing still, you know, as battery technology

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01:38:16.490 --> 01:38:18.129

Andre Freeman: charging technology.

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01:38:18.130 --> 01:38:28.830

Andre Freeman: As infrastructure... charging infrastructure itself, you know, improves over time, like, all those things are gonna, you know, require us to, again, continue grounding things in the real world as we forecast.

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01:38:31.070 --> 01:38:33.770

Qing Tian: Thank you, very helpful. Back to you, Commissioner McAllister.

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01:38:33.770 --> 01:38:35.609

Commissioner Andrew McAllister: Great. Thanks, Qing.

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01:38:36.100 --> 01:38:46.849

Commissioner Andrew McAllister: Let's see, I guess, along that line, like, the load flexibility and the behavior aspects here are super, super important, and I wanted to actually ask about the heavy-duty space.

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01:38:48.990 --> 01:39:05.090

Commissioner Andrew McAllister: what do we kind of know, or... I guess, maybe, what's the range of uncertainty? I know it's hard to ask about, you know, hard to qualify uncertainty, you know, with limited information, but, you know, just that technology, you know, with the...

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01:39:05.130 --> 01:39:12.289

Commissioner Andrew McAllister: big rig, you know, electric big rigs that Tesla's now, you know, producing and has amazing, you know, huge aspirations for.

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01:39:12.590 --> 01:39:20.850

Commissioner Andrew McAllister: I mean, charging one of those things is, you know, that's... and certainly a bank of them. I mean, that's a... definitely a transmission-level interconnection.

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01:39:21.240 --> 01:39:28.249

Commissioner Andrew McAllister: So that's a serious capacity, right, that you need, and I wonder, is...

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01:39:28.530 --> 01:39:34.410

Commissioner Andrew McAllister: Is there work going on to kind of... I mean, I imagine the scenario... the range of scenarios must be just huge.

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01:39:34.510 --> 01:39:41.880

Commissioner Andrew McAllister: It's really hard to grapple with, but, that has direct implications for investment, the transmission grid, sub-transmission.

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01:39:42.190 --> 01:39:52.570

Commissioner Andrew McAllister: Are we, are various teams interacting on that, in terms of, you know, how that might drive capital costs? Working with the CAISO, say, and...

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01:39:52.790 --> 01:40:06.400

Commissioner Andrew McAllister: Where... where are we grappling with that? It seems like quite a multi-team effort that would be needed to... to get a handle on that, and I'm kind of wondering what our... what the forecast team's role is, and... and... and who the other components are of that, of thinking that through.

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01:40:07.510 --> 01:40:18.659

Andre Freeman: Yeah, so that's a great question, which one we have discussed with, I mean, IOUs, POUs, that's a huge... that's one of the first things we usually talk about, especially over the last few months, as we prepare for the forecast.

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01:40:18.660 --> 01:40:32.129

Andre Freeman: The uncertainty there for folks, especially smaller groups like the smaller POUs, it can have a much more outsized impact for them, and so the uncertainty associated with this sector impact on them is, again, a huge issue that we're talking through.

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01:40:32.130 --> 01:40:41.620

Andre Freeman: how best to, in the face of the uncertainty, which I mentioned before, which plays in, especially the regulatory uncertainty, which plays in heavily with the medium-heavy duty sector,

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01:40:41.620 --> 01:40:57.460

Andre Freeman: you know, how can they do planning? How can they do, you know, resource planning, infrastructure planning, what have you? And a lot of it comes down to knowing your customers, looking at the customer request data that's coming in, taking proactive steps to reach out to prospective customers, like the Teslas of this world, who can

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01:40:57.460 --> 01:41:07.079

Andre Freeman: you know, telegraph. They're not going to say at the last minute, this is where the infrastructure's going. They will help, you know, work with the utilities early to develop that infrastructure. So...

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01:41:07.240 --> 01:41:26.450

Andre Freeman: you know, as we look at kind of our... how that plays into our forecasts and kind of our role in that, it's kind of two-sided. So, on one side, we are forecasting, you know, long-term policy implications and, you know, how the growth of the medium and heavy duty sector might play out, especially with future regulations or incentive programs being significant drivers for that.

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01:41:26.450 --> 01:41:36.660

Andre Freeman: But I think a lot of that concern that you're mentioning right now is really in the near term, like the next 3 to 5 years. What obligations do utilities have to be ready to meet for their customers?

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01:41:37.050 --> 01:42:01.989

Andre Freeman: And a lot of it is just, you have to rely less on, kind of, forecasting and scenario development compared to the light duty sector, and really be more focused on working directly with the truck manufacturers, the fleets that are interested in doing this, the many infrastructure providers who are strictly focused on the medium and heavy duty vehicle sector, to really keep your thumb on top of, like, exactly what's happening.

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01:42:01.990 --> 01:42:06.489

Andre Freeman: in the real world of the next couple of years, and their proposed plans.

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01:42:06.490 --> 01:42:31.390

Andre Freeman: And then similarly, one of the other big impacts, you look at places like the ports of LA and Long Beach, who have a significant on- and off-road vehicle fleet that operate on and nearby their facilities throughout the year. They've had years of clean vehicle programs, and they continue, even outside of the regulatory world, to continue to push for zero-emission trucks to be visiting their facilities, the equipment to get cleaner that's operating at their

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01:42:31.390 --> 01:42:33.220

Andre Freeman: facilities,

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01:42:33.240 --> 01:42:46.149

Andre Freeman: So it's really down at that level, that ground level of planning, where you have to capture all that information from all those different sources to really say, you know, here's... here's a good reflection of what's likely to happen in the near term.

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01:42:46.190 --> 01:42:59.569

Andre Freeman: But again, there's still significant uncertainty about, especially in the regulatory environment, which will happen over the long term. So I think all the entities, especially the utilities, who are grappling with this, of, again.

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01:42:59.580 --> 01:43:13.190

Andre Freeman: how do they take that appropriate balance of being able to meet the obligations for their customers versus, you know, not overestimating the demand that's going to come out and, you know, having that impact rate payers? That's just continuing to be an ongoing challenge.

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01:43:13.190 --> 01:43:22.549

Commissioner Andrew McAllister: Okay, yeah, that makes sense, having to map it onto, kind of, like, the details matter, you know, where there's already capacity, maybe that's the, you know, the place you gotta focus on.

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01:43:22.730 --> 01:43:26.100

Commissioner Andrew McAllister: Are we working with the PUC, to kind of...

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01:43:26.760 --> 01:43:34.189

Commissioner Andrew McAllister: You know, triangulate with... with the utilities, in that... in those efforts to kind of get a handle on

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01:43:34.360 --> 01:43:38.580

Commissioner Andrew McAllister: You know, the pragmatic path, bet.

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01:43:38.860 --> 01:43:48.709

Commissioner Andrew McAllister: that, you know, utilities have to really be focused on, you know, the... what are they proposing to get recovery for to the PUC, and I imagine the PUC would look to us for some

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01:43:49.010 --> 01:43:50.240

Commissioner Andrew McAllister: kind of...

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01:43:50.340 --> 01:43:56.890

Commissioner Andrew McAllister: you know, validation or sort of analysis of those proposals. Are we kind of operating in that way?

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01:43:57.800 --> 01:44:05.020

Andre Freeman: Yes, I would say a significant amount of our time, a majority of our time outside of actually producing the IEPR forecast is spent

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01:44:05.600 --> 01:44:16.340

Andre Freeman: Working with utilities, working with the Public Utilities Commission, working with CAISO, again, working with everybody in this space to... and a lot of it is about just data sharing.

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01:44:16.340 --> 01:44:32.779

Andre Freeman: You know, again, customer request data coming from the utilities to give us a little bit of insight of the demand that they're seeing from that side. Obviously, we produce the IEPR forecast, which is kind of the baseline input for a lot of the various planning efforts that go into the other energy agencies and utilities.

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01:44:33.140 --> 01:44:38.650

Andre Freeman: And then there's other efforts, such as the PUC's Transportation Electrification Proactive Planning Effort.

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01:44:38.650 --> 01:44:56.889

Andre Freeman: Which is outside of kind of our... the normal regulatory environment at the Public Utilities Commission, but kind of a standalone effort where we use that as an opportunity to develop new tools, utilize new data sources to really plot out where things like the medium and heavy duty infrastructure development will be going in the future. So yeah, there's...

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01:44:56.890 --> 01:44:57.960

Commissioner Andrew McAllister: DAWG as well, right?

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01:44:57.960 --> 01:45:00.419

Andre Freeman: Yeah, I mean, there's... there's many different forums.

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01:45:00.420 --> 01:45:00.750

Commissioner Andrew McAllister: Yes.

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01:45:00.750 --> 01:45:14.700

Andre Freeman: You know, I spend probably as much time talking to those other agencies as I do talking to people within the Energy Commission, so, there's definitely a lot of

coordinated efforts. And I should also mention that, especially with the Air Resources Boards.

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01:45:14.700 --> 01:45:31.689

Andre Freeman: kind of role in the electrification and transportation sector. Obviously, we have a lot of conversations with them throughout the year to see not only what's happening with their regulations that they have on the books, but kind of the prospective look at what's going to happen in the future, and get their input on how we might reflect that in our forecast.

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01:45:31.890 --> 01:45:37.059

Commissioner Andrew McAllister: Okay, that's super helpful. Yeah, really good to know that coordination is happening, data sharing.

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01:45:38.740 --> 01:45:46.109

Commissioner Andrew McAllister: I wonder on... more on the light-duty side, but I guess, you know, maybe other categories of transport as well.

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01:45:46.590 --> 01:45:53.760

Commissioner Andrew McAllister: How much do we kind of know about price responsiveness.

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01:45:54.550 --> 01:46:08.749

Commissioner Andrew McAllister: In terms of... I mean, I imagine it's probably different, like, home charging, and out there in the wild, and all that, like, but just personal experience, I kind of just noticed that there's a lot of demand for those chargers out there, particularly, you know, in high-density areas.

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01:46:08.980 --> 01:46:10.790

Commissioner Andrew McAllister: And...

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01:46:11.600 --> 01:46:21.460

Commissioner Andrew McAllister: the various, you know, the Electrify America, and the Tesla Superchargers, and all the other ones that are out there, they seem to kind of have different,

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01:46:21.710 --> 01:46:23.530

Commissioner Andrew McAllister: consumer experiences.

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01:46:24.140 --> 01:46:30.849

Commissioner Andrew McAllister: like, far and beyond just the price you pay, but certainly price is an element there. Some are more expensive than others, and some have

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01:46:31.000 --> 01:46:41.530

Commissioner Andrew McAllister: time-based pricing. Are we... are we gathering, how much do we know about that? Like, are we... do we have, sources of data, either that were compelling.

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01:46:41.710 --> 01:46:49.909

Commissioner Andrew McAllister: reporting of, or just data sharing, because it's in everyone's interest. I know that our data regs have grappled with this a bit as well.

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01:46:50.250 --> 01:46:58.940

Commissioner Andrew McAllister: In terms of, sort of, the price responsiveness, you know, getting insight that actually is usable for you in the forecasting work.

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01:46:59.200 --> 01:47:00.860

Commissioner Andrew McAllister: Where do we stand with that?

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01:47:02.160 --> 01:47:07.509

Andre Freeman: So, we're definitely collecting data in this area. As you can imagine, for all the reasons you just mentioned, it's challenging.

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01:47:07.510 --> 01:47:23.800

Andre Freeman: So we do have some of this information, which comes through our California Vehicle Survey, which part of it is, you know, an economic component that looks

at how people look at fuel prices, in this case, how EV charging prices might influence their behavior, as well as upfront capital costs of electric vehicles.

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01:47:24.810 --> 01:47:33.579

Andre Freeman: Our Fuels and Transportation Division also has efforts in place to collect information directly from all the infrastructure that they're funding, so that's going to be a good resource for.

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01:47:33.580 --> 01:47:34.069

Commissioner Andrew McAllister: We're gonna get.

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01:47:34.070 --> 01:47:41.299

Andre Freeman: Real-world information that shows, you know, a wide variety of chargers and a wide variety of locations throughout the state.

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01:47:41.460 --> 01:47:59.019

Andre Freeman: what kind of responsiveness there is. There's also been, you know, independent research done, which is very helpful in this area, which really looks at, you know, academic institutions, really looking at pilot projects of data collection for, you know, a subset of the vehicles out there to see how people are changing their charging behavior based on costs.

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01:47:59.020 --> 01:48:07.799

Andre Freeman: And then there's other groups, like some of the manufacturers for light-duty vehicles have put out information based on their onboard telematics to really look at.

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01:48:07.800 --> 01:48:08.240

Commissioner Andrew McAllister: Oh, wow.

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01:48:08.810 --> 01:48:10.479

Andre Freeman: I mean, it's shown things as far

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01:48:10.860 --> 01:48:29.379

Andre Freeman: Yeah, some consumers for certain vehicle types and certain, you know, cost demographics for vehicles, are going to respond differently than, say, you know, if you have a more expensive vehicle, it does get to a certain place where, you know, some of the manufacturers said, you know, our consumers really don't care.

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01:48:29.380 --> 01:48:29.730

Commissioner Andrew McAllister: Yeah.

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01:48:29.730 --> 01:48:41.970

Andre Freeman: You know, it's... it's minor cost changes of, like, you know, 5-10% difference in cost. It doesn't matter to the way they... they're gonna charge. It's based off of a convenience factor. You know, if...

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01:48:41.970 --> 01:48:52.980

Andre Freeman: You know, somebody's, you know, they have the option of, you know, going home, charging the residents, versus, well, maybe it's more convenient to go to their local supercharging facility, which might have a higher cost, but

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01:48:53.040 --> 01:49:05.560

Andre Freeman: again, much more convenient and quicker for them, that there is, you know, behavior associated with that. So, there is a fair amount of data being collected. Obviously, we need to do more. It is... it is a challenge without, you know, a

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01:49:05.590 --> 01:49:22.319

Andre Freeman: Knowing what every charger's doing out there, and being able to track individual vehicle owners across those range of charges that they could utilize. But there is starting to be a decent amount of information available to understand... better understand consumer behavior and reactions to changing rates.

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01:49:22.630 --> 01:49:35.620

Commissioner Andrew McAllister: Great. Great, yeah, that's super, super important work. I mean, just given... given the amount of energy we're talking about in the next few years, it's gonna be ramping up, and just, yeah, wanna... wanna have all the levers in front of us and kind of know how big they are.

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01:49:38.220 --> 01:49:45.039

Commissioner Andrew McAllister: Well, great, I don't have any other questions. We're a little bit ahead of schedule, a fair amount ahead of schedule, I think.

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01:49:45.940 --> 01:49:47.489

Commissioner Andrew McAllister: But, that's okay.

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01:49:47.880 --> 01:49:52.700

Commissioner Andrew McAllister: I think, I think, I think we're good, and we'll pass it. Thanks a lot, Andre, appreciate you.

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01:49:53.220 --> 01:49:57.019

Commissioner Andrew McAllister: Thanks to the team as well, and we'll, send it back to Sandra.

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01:49:57.320 --> 01:50:10.139

Sandra Nakagawa: Thank you, Andre. Thank you, Commissioner McAllister and Qing. I'll also remind all of the folks who are participating, you're welcome to ask questions using Zoom's Q&A feature, so feel free to use that if you do want to ask any follow-ups.

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01:50:10.140 --> 01:50:24.889

Sandra Nakagawa: To our panelists today. And with that, I'm happy to introduce, Ethan Cooper. Ethan is an Electric Generation Systems Specialist at the Energy Commission. Ethan's going to kick off our section on energy efficiency and fuel substitution updates.

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01:50:27.250 --> 01:50:38.339

Ethan Cooper: Thanks, Sandra. Yep, good morning, everyone. As Sandra mentioned, I'm Ethan Cooper, and I'm going to present on this year's characterization for our energy efficiency and fuel substitution load modifiers. Next slide, please.

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01:50:39.680 --> 01:50:48.349

Ethan Cooper: This is just a quick list of acronyms, abbreviations, and initialisms I'll be using throughout today's presentation. They're all posted online for your reference in case anything is unfamiliar to you.

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01:50:48.760 --> 01:50:49.999

Ethan Cooper: Next slide, please.

722

01:50:50.710 --> 01:50:57.450

Ethan Cooper: Start today, I'm... oh. To start today, I'm going to give a brief overview on what our EE and FS Load Modifiers are.

723

01:50:58.240 --> 01:51:11.100

Ethan Cooper: So, additional achievable energy efficiency and fuel substitution capture a range of incremental market potential impacts which go beyond what is already included in our baseline demand forecast, but are within the range of what is reasonably expected to occur.

724

01:51:12.050 --> 01:51:27.040

Ethan Cooper: These load modifiers are split by us into three main components. The first two are the programs and incremental Codes of Standards, or PiCS components, which look at modeling energy efficiency savings and fuel substitution impacts from various programs, building standards, and appliance standards.

725

01:51:27.290 --> 01:51:31.219

Ethan Cooper: This modeling is all done using our PiCS tool and various Excel workbooks.

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01:51:31.950 --> 01:51:43.069

Ethan Cooper: The final zero emission, or ZE component, looks at additional fuel substitution for ZE appliance adoption that goes above and beyond what is already realized in our PiCS fuel substitution scenarios.

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01:51:43.480 --> 01:51:50.969

Ethan Cooper: The ZE modeling at the very bottom of the table is all done using our Fuel Substitution Scenario Analysis Tool, or as we call it, FSSAT for short.

728

01:51:51.520 --> 01:51:52.750

Ethan Cooper: Next slide, please.

729

01:51:54.210 --> 01:51:57.129

Ethan Cooper: How do these load modifiers impact energy demand?

730

01:51:58.200 --> 01:52:02.530

Ethan Cooper: Energy efficiency reduces both gas consumption and electricity consumption.

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01:52:02.980 --> 01:52:09.990

Ethan Cooper: Fuel substitution, on the other hand, only reduces gas consumption, and actually has a consequent impact on increasing electricity demand.

732

01:52:10.290 --> 01:52:12.560

Ethan Cooper: Because of this interactive effect for fuel sub.

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01:52:12.700 --> 01:52:21.040

Ethan Cooper: We define energy efficiency as having energy savings, and fuel substitution as having energy impacts - reduces gas, but increases electricity demand.

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01:52:22.170 --> 01:52:23.910

Ethan Cooper: With that, next slide, please.

735

01:52:25.070 --> 01:52:30.000

Ethan Cooper: Our next few slides are now going to go over the major modeling updates that we have for this IEPR cycle.

736

01:52:30.310 --> 01:52:31.479

Ethan Cooper: Next slide, please.

737

01:52:33.290 --> 01:52:39.080

Ethan Cooper: Our scenario framework for the 2026 IEPR cycle remains relatively unchanged since 2025.

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01:52:39.370 --> 01:52:43.860

Ethan Cooper: But before getting into that framework, I do want to note a few things on the slide first.

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01:52:44.230 --> 01:52:52.339

Ethan Cooper: The first is that the Heat Pump Partnership has reported that around 2.4 million heat pumps have been installed in the state of California as of April of this year.

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01:52:53.080 --> 01:52:57.380

Ethan Cooper: The second is that there have been some evolution in our policies since the last IEPR cycle.

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01:52:57.820 --> 01:53:03.930

Ethan Cooper: The California Air Resources Board, or CARB, introduced their Clean Space and Water Heater standards late last year.

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01:53:04.070 --> 01:53:11.810

Ethan Cooper: And the Bay Area Air District is also currently considering some amendments to their zero-NOx water heater standards, which were adopted back in 2023.

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01:53:13.280 --> 01:53:21.620

Ethan Cooper: Along with this, California's cities and counties have also recently adopted a significant number of new local rules that require building electrification.

744

01:53:22.090 --> 01:53:26.550

Ethan Cooper: Especially when existing equipment is being replaced, or when buildings are being renovated.

745

01:53:27.360 --> 01:53:35.780

Ethan Cooper: These rules are too early to have been included in our 2025 IEPR scenarios, but they will be incorporated during our 2027 forecast next year.

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01:53:36.410 --> 01:53:39.240

Ethan Cooper: Focusing now on the 2026 IEPR update.

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01:53:39.410 --> 01:53:48.250

Ethan Cooper: We are making no changes or updates to our PiCS scenarios, and only making minor assumption changes for the residential and commercial side of our ZE fuel substitution.

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01:53:49.080 --> 01:54:01.939

Ethan Cooper: As for major modeling updates this year, we are going to be incorporating FSSAT industrial electrification within our most aggressive AAFS Scenario 6, which my colleague Jonathan Margoliash will discuss further during his slides after me.

749

01:54:02.390 --> 01:54:14.069

Ethan Cooper: One last thing I want to mention on the slide here before moving on is that we are planning for some major model and scenario framework updates for the 2027 IEPR forecast, which I'll talk more about at the end of my presentation today.

750

01:54:14.760 --> 01:54:15.999

Ethan Cooper: Next slide, please.

751

01:54:17.840 --> 01:54:24.650

Ethan Cooper: For our policy modeling this year, we're going to be updating our assumptions only for the Bay Area Air District's Rule 9-6.

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01:54:25.300 --> 01:54:30.759

Ethan Cooper: Our new assumptions for this rule are based on the Bay Area's proposed flexibility amendments for the rule.

753

01:54:31.450 --> 01:54:36.899

Ethan Cooper: which are found in their July 2026 draft proposal, and have yet to be adopted.

754

01:54:37.890 --> 01:54:46.289

Ethan Cooper: The updates this year are going to be delaying the implementation start dates for Zero NOx water heaters, both in residential and commercial buildings, to the dates shown on this slide.

755

01:54:47.250 --> 01:54:51.950

Ethan Cooper: The Air District's proposed low-income exemptions, however, are going to be excluded in our modeling.

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01:54:52.300 --> 01:55:01.009

Ethan Cooper: This is done to maintain more consistency with the conservative ZE fuel substitution scenarios, that is 1 and 2, which do not include any modeling for the air districts.

757

01:55:01.650 --> 01:55:08.730

Ethan Cooper: Aside from this, we're going to continue to use the 2025 IEPR adoption scheme for the modeling of the other local air district rules.

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01:55:08.850 --> 01:55:14.930

Ethan Cooper: And for the modeling of CARB's scoping plan scenario, and CARB's earlier concept of their space and water heater standard.

759

01:55:15.460 --> 01:55:16.680

Ethan Cooper: Next slide, please.

760

01:55:22.630 --> 01:55:26.480

Ethan Cooper: So... Looking at some additional modeling updates this year.

761

01:55:26.720 --> 01:55:38.110

Ethan Cooper: FSSAT is going to continue to use its high-efficiency weighting for residential water heater replacements, but it's now going to be removing electric resistance as one of the available replacement technologies starting in 2029.

762

01:55:38.470 --> 01:55:46.059

Ethan Cooper: This change here is likely going to be reducing the electric impacts we see for the water heating end use in our ZE fuel substitution impacts.

763

01:55:47.100 --> 01:55:53.990

Ethan Cooper: Along with this, FSSAT is now using the final version of our 2025 IEPR baseline gas and electric demand forecasts.

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01:55:54.630 --> 01:55:57.780

Ethan Cooper: And finally, as discussed in the past, in the last slide.

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01:55:58.130 --> 01:56:07.460

Ethan Cooper: We're going to be including our FSSAT industrial electrification modeling within AAFS Scenario 6 this year, which, as I mentioned earlier, my colleague Jonathan is going to talk more about later.

766

01:56:08.420 --> 01:56:09.909

Ethan Cooper: Next slide, please.

767

01:56:11.780 --> 01:56:18.379

Ethan Cooper: Alright, we're now going to look at the characterization that we have for the residential and commercial side of the ZE fuel substitution modeling.

768

01:56:18.670 --> 01:56:19.890

Ethan Cooper: Next slide, please.

769

01:56:21.010 --> 01:56:26.539

Ethan Cooper: Starting off with this flowchart here, I just give a quick overview of FSSAT and how the tool models electrification.

770

01:56:27.050 --> 01:56:38.310

Ethan Cooper: We first use our PiCS energy... or, excuse me, our PiCS fuel substitution savings to reduce our gas demand forecast once, and then after that, apply our technology-based fuel substitution via FSSAT.

771

01:56:39.230 --> 01:56:43.009

Ethan Cooper: Once all of our fuel substitution impacts are accounted for.

772

01:56:43.330 --> 01:56:48.820

Ethan Cooper: We then use our gas PiCS energy efficiency savings to reduce the gas demand forecast one last time.

773

01:56:49.390 --> 01:57:02.119

Ethan Cooper: Now, since FSSAT models fuel substitution impacts before energy efficiency, our tool will also modify our gas PiCS energy efficiency scenario to only show savings that are possible, given our chosen fuel substitution scenario.

774

01:57:03.200 --> 01:57:18.169

Ethan Cooper: Finally, our FSSAT tool will then output both the annual and hourly ZE fuel substitution impacts, and then use separate modules to go combine them with our impacts for the PiCS modeling, which is what eventually goes over for our demand forecast.

775

01:57:19.300 --> 01:57:20.560

Ethan Cooper: Next slide, please.

776

01:57:22.590 --> 01:57:33.080

Ethan Cooper: Alright, this table below now details the characterizations that we have for this year's 6 fuel substitution scenarios, which, as we note at the top of the title, is the same as what we had last year.

777

01:57:33.990 --> 01:57:37.400

Ethan Cooper: Focusing on our ZE modeling, which is the bottom rows.

778

01:57:37.660 --> 01:57:45.550

Ethan Cooper: All scenarios model gas-fuel substitution, both for space and water heating, while scenarios 5 and 6 also include cooking and clothes drying.

779

01:57:46.050 --> 01:57:50.319

Ethan Cooper: Residential propane substitution also starts happening in our Scenario 6.

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01:57:51.170 --> 01:57:52.670

Ethan Cooper: for our ZE,

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01:57:53.080 --> 01:58:02.010

Ethan Cooper: Statewide ZE modeling for new construction buildings, anything that goes beyond what is already included in our PiCS Title 24 impacts, that begins in Scenario 4.

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01:58:02.490 --> 01:58:12.649

Ethan Cooper: For our statewide ZE modeling within existing buildings, we have various replace on burnout or ROB adoption curves that apply to each scenario. I'll discuss more about that on the next slide.

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01:58:12.830 --> 01:58:22.260

Ethan Cooper: But for the final two rows here, we're including the local air district modeling for the Bay Area and South Coast Adopted rules within our scenarios 3 through 6.

784

01:58:22.900 --> 01:58:24.150

Ethan Cooper: Next slide, please.

785

01:58:26.020 --> 01:58:34.810

Ethan Cooper: The chart below not just details the statewide ROB adoption curves that I mentioned in the previous slide, which, same as our characterizations, is the same as what we had last year.

786

01:58:35.500 --> 01:58:41.190

Ethan Cooper: FSSAT will distribute the amount of gas that will expire or burn out each year based on assumed effective useful life.

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01:58:41.410 --> 01:58:49.720

Ethan Cooper: These ROB adoption rates are thus indicating the percentage of each year's expiring gas appliances that will be replaced with a ZE alternative, such as a heat pump.

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01:58:50.680 --> 01:58:59.590

Ethan Cooper: Our orange line is used for Scenario 1, and the blue line is used for Scenario 2, and these two lines constitute our different gradual transformation, or GT, scenarios.

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01:59:00.400 --> 01:59:08.190

Ethan Cooper: The dashed purple and brown lines are used for the modeling of CARB's scoping Plan in Scenario 3, with different lines for the residential versus commercial sectors.

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01:59:09.030 --> 01:59:14.530

Ethan Cooper: The single green line to the very far left is used for our modeling in scenarios 4 through 6.

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01:59:14.830 --> 01:59:24.340

Ethan Cooper: Again, Scenario 4 just models CARB's earlier concept of their space and water heater standard, while Scenarios 5 and 6 go beyond that standard to look at other end uses and fuel types.

792

01:59:24.920 --> 01:59:36.039

Ethan Cooper: Before moving on from here, I do want to quickly note that we recently took a deeper dive into how our fuel substitution model estimates how many gas residential space and water heaters can be replaced each year.

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01:59:36.640 --> 01:59:40.540

Ethan Cooper: This has been a curious question that has been raised several times for this topic.

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01:59:42.040 --> 01:59:47.369

Ethan Cooper: As we all know, models are not a perfect depiction of reality, so take our numbers today with a grain of salt.

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01:59:48.110 --> 02:00:01.119

Ethan Cooper: Our modeling shows that somewhere between 2 to 2.1 million residential gas space and water heaters can be swapped out annually, and roughly 80%, or about 1.6 million of those, are replacements seen in existing buildings.

796

02:00:02.370 --> 02:00:04.120

Ethan Cooper: With that. Next slide, please.

797

02:00:05.380 --> 02:00:10.300

Ethan Cooper: Alright, my last slide is going to be on the future FSSAT modeling updates for the next IEPR cycle.

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02:00:10.470 --> 02:00:11.690

Ethan Cooper: Next slide, please.

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02:00:12.840 --> 02:00:21.029

Ethan Cooper: So, as mentioned earlier, the 2027 IEPR forecast is going to be used as a fresh slate when characterizing all of our fuel substitution scenarios.

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02:00:21.350 --> 02:00:29.200

Ethan Cooper: We're going to work closely with CARB to model their revised clean space and water heater standards, which we heard is likely going to board hearing sometime next year.

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02:00:29.730 --> 02:00:36.290

Ethan Cooper: We'll also review any new or revised local air district rules that relate to zero emission or zero NOx requirements.

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02:00:37.800 --> 02:00:48.240

Ethan Cooper: Finally, we're also going to be looking at expanding both our industrial and agricultural FSSAT modeling to be included in additional fuel substitution scenarios, rather than just the most aggressive Scenario 6.

803

02:00:49.180 --> 02:01:03.960

Ethan Cooper: Along with this, structural improvements are also going to be made to our FSSAT tool. This will include improving our tool's appliance stock accounting, and refining our tool's annual adoption methodology, both of which are going to be used for helping us with modeling CARB's clean space and water heater standard.

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02:01:05.140 --> 02:01:10.459

Ethan Cooper: And finally here, routine updates to our FSSATs data inputs are also going to continue for the next year.

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02:01:10.830 --> 02:01:16.809

Ethan Cooper: This includes incorporating the 2027 IEPR vintage for both the baseline demand forecast and buildings forecasts.

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02:01:17.520 --> 02:01:18.790

Ethan Cooper: Next slide, please.

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02:01:20.330 --> 02:01:32.420

Ethan Cooper: That is the end of my presentation. I'd like to thank everybody today for listening in, and I'm going to now pass it on to Jonathan, who will be discussing the FSSAT industrial electrification modeling for AAFS Scenario 6. Go ahead, Jonathan.

808

02:01:38.600 --> 02:01:50.779

Jonathan Margoliash: Hello! Thank you, Ethan. Hi, all. I'm Jonathan Margoliash, and I will be presenting today our plans to include industrial electrification modeling in AAFS6.

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02:01:50.910 --> 02:01:52.110

Jonathan Margoliash: Next slide, please.

810

02:01:52.800 --> 02:02:03.010

Jonathan Margoliash: So, AAFS is our set of scenarios modeling additional achievable fuel substitution, particularly electrification scenarios.

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02:02:03.270 --> 02:02:08.499

Jonathan Margoliash: And Scenario 6 is our most aggressive of these scenarios. Next slide, please.

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02:02:09.300 --> 02:02:14.459

Jonathan Margoliash: So I'm going to start with some rationale, like, why are we considering industrial electrification this year?

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02:02:14.570 --> 02:02:25.300

Jonathan Margoliash: I am going to explain our plan's relationship to existing forecast components, and then I'm going to dive into the plan itself, its origins in the 2023 Demand Scenarios project.

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02:02:25.480 --> 02:02:30.139

Jonathan Margoliash: The policies that are the basis for this modeling, and then the details of the modeling itself.

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02:02:30.660 --> 02:02:34.170

Jonathan Margoliash: And then I'll wrap up with some plans for future forecast cycles.

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02:02:34.820 --> 02:02:36.249

Jonathan Margoliash: Next slide, please.

817

02:02:37.480 --> 02:02:38.610

Jonathan Margoliash: Next slide.

818

02:02:39.120 --> 02:02:50.419

Jonathan Margoliash: So, why are we doing this this year? So, 2025's based forecast, suggests that there will be little change in industrial gas usage out through 2045.

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02:02:50.710 --> 02:03:06.729

Jonathan Margoliash: And our existing scenarios model very little, less than 1% industrial electrification over that time frame. So this is... between these two, our previous modeling is suggesting that, you know, industrial gas usage in California is not going to change much over the next 20 years.

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02:03:07.080 --> 02:03:17.090

Jonathan Margoliash: But we know that there is growing policy interest and technological development and preliminary deployments of industrial electrification, so this is suggesting that

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02:03:17.200 --> 02:03:24.570

Jonathan Margoliash: There is a, you know, a plausible future outcome that our scenarios are missing, and that this is what this plan is attempting to address.

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02:03:25.030 --> 02:03:30.269

Jonathan Margoliash: We also have stakeholder comments suggesting that there is a growing demand for industrial electrification that we should be modeling.

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02:03:30.520 --> 02:03:44.070

Jonathan Margoliash: And saying that our AAFS scenarios are too narrow, that they don't consider a broad enough range of plausible market and policy outcomes, and including industrial electrification in AAFS6 helps address these concerns.

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02:03:44.790 --> 02:03:45.980

Jonathan Margoliash: Next slide, please.

825

02:03:49.030 --> 02:03:53.690

Jonathan Margoliash: So, this, is the, describes...

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02:03:53.870 --> 02:04:12.910

Jonathan Margoliash: the relationship of this new component to the rest of the components of our AAFS modeling. This is similar to what Ethan presented before, I'm not going to go into all the details, but I'll give a brief overview. We start with the baseline gas

demand forecast, and then we apply our existing fuel substitution modeling, our existing electrification modeling.

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02:04:13.030 --> 02:04:30.680

Jonathan Margoliash: And then we get to this orange box, which is what we're adding, which is a new grouping of industrial electrification modeling. Note that this orange box, as Ethan has talked about, already existed in the residential and commercial sectors. What's new here is that we're adding this modeling to the industrial sector.

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02:04:30.680 --> 02:04:36.459

Jonathan Margoliash: We then apply our energy efficiency modeling as normal, and from that get, annual outputs.

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02:04:36.530 --> 02:04:39.359

Jonathan Margoliash: And then we use Load Shapes to get hourly output from that.

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02:04:39.770 --> 02:04:47.880

Jonathan Margoliash: Of note, our load shapes are now based on interval meter data that the CEC has, as opposed to an older dataset that was used previously.

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02:04:48.750 --> 02:04:53.329

Jonathan Margoliash: One caveat on this slide, you will see mention of agricultural,

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02:04:53.450 --> 02:05:05.430

Jonathan Margoliash: modeling and of, hydrogen fuel substitution modeling. Those are capacity... capabilities of the tool we've built out, but not things we plan to add to this forecast cycle. We're just looking at industrial electrification.

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02:05:06.300 --> 02:05:07.760

Jonathan Margoliash: Next slide, please.

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02:05:09.160 --> 02:05:11.950

Jonathan Margoliash: Okay, so what are we actually proposing for this year? Next slide.

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02:05:13.290 --> 02:05:22.690

Jonathan Margoliash: So our plan, centers around, the 2023 Demand Scenarios project. This is work done by other CEC staff that was published this year.

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02:05:22.840 --> 02:05:36.709

Jonathan Margoliash: It built out an industrial electrification framework, and then scenarios for how electrification might play out within that framework. It also included a programmatic tool, FSAT,

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02:05:36.820 --> 02:05:41.710

Jonathan Margoliash: for, doing the accounting for these scenarios.

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02:05:41.950 --> 02:05:57.949

Jonathan Margoliash: The policy basis for this work focused on some key legislation, including the Infrastructure Investment and Jobs Act and the Inflation Reduction Act, especially a few incentives such as the 48C Manufacturing Tax Credit and the Advanced Industrial Facilities Deployment Program.

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02:05:58.200 --> 02:05:59.160

Jonathan Margoliash: Now...

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02:05:59.680 --> 02:06:10.790

Jonathan Margoliash: The deployment program has since been rescinded, but the 48C manufacturing tax credit largely remains, and it's investing \$1.2 billion in industrial decarbonization.

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02:06:10.880 --> 02:06:25.609

Jonathan Margoliash: And so there's still a lot of the modeling that was done around these incentives that can be applied to the present day, and so we're planning to incorporate the 2023 demand scenarios modeling in our industrial AAFS6 scenario.

842

02:06:25.660 --> 02:06:31.520

Jonathan Margoliash: And then for 2027, we're planning to do additional updates and research to improve this modeling.

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02:06:31.890 --> 02:06:33.180

Jonathan Margoliash: Next slide, please.

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02:06:34.660 --> 02:06:54.310

Jonathan Margoliash: To be specific, we're intending to take the enhanced policy scenario from the 2023 demand scenarios project. We're going to only look at the industrial sector, only electrification, not hydrogen fuel substitution, and then we're going to apply a 50% discount, due to the fact that there are significant changes in federal policy since 2023.

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02:06:56.340 --> 02:07:11.240

Jonathan Margoliash: I want to give a note here that the industrial electrification is a very nascent field right now, and that leads to a lot of modeling uncertainty. It's just... it's an inherently difficult field to model.

846

02:07:11.310 --> 02:07:24.790

Jonathan Margoliash: We think that our scenarios benefit from modeling it as opposed to avoiding it just because it's uncertain. And we think that, Scenario 6, our most aggressive scenario, is the appropriate place for that uncertainty.

847

02:07:25.160 --> 02:07:33.079

Jonathan Margoliash: But that is... but we acknowledge that there is inherent uncertainty in trying to model, industrial electrification.

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02:07:34.020 --> 02:07:35.179

Jonathan Margoliash: Next slide.

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02:07:38.510 --> 02:07:44.999

Jonathan Margoliash: So, now I'd like to get into the details of exactly what, this model... what modeling we're present... proposing.

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02:07:45.010 --> 02:08:03.859

Jonathan Margoliash: So we're gonna take, California gas usage in the industrial sector and split it into 46 different subsectors. And then for each of these subsectors, we're going to characterize what percentage of gas is used for thermal end uses, for process heating, as opposed to, like, electricity generation or, you know, space heating for, workers.

851

02:08:04.150 --> 02:08:13.899

Jonathan Margoliash: And then we're going to split that gas usage for process heating up into 3 different temperature bands. Below 100 degrees C, between 100 and 200 degrees C, and above 200 degrees C.

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02:08:14.460 --> 02:08:26.100

Jonathan Margoliash: For each of those, we're going to assume a conversion factor, which describes, how many kilowatt hours of electricity need to replace any therm of gas abated.

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02:08:27.390 --> 02:08:38.790

Jonathan Margoliash: So, this describes the potential for electrification, but next slide, please. This following slide describes what our assumptions are about what electrification will actually occur.

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02:08:39.140 --> 02:08:52.000

Jonathan Margoliash: So, staff judgment was used, to assume electrification rates for each different temperature range. You can see below, there's a less than 100 degree C range in blue, and between 100 and 200 degree C range in the orange.

855

02:08:52.380 --> 02:09:03.800

Jonathan Margoliash: This modeling is assuming that through the early or mid-2030s, this is being driven mostly by federal policy, and then after that, there's market adoption, which causes the,

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02:09:04.010 --> 02:09:06.569

Jonathan Margoliash: Adoption to move from there.

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02:09:07.680 --> 02:09:11.330

Jonathan Margoliash: These rates are the same across subsectors.

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02:09:11.440 --> 02:09:25.839

Jonathan Margoliash: So if, let's say, paper manufacturing and chemicals manufacturing both use less than 100 degrees C heating, then the same percentage of that heating will electrify in both of those subsectors. That's the assumption being made.

859

02:09:25.840 --> 02:09:36.489

Jonathan Margoliash: That's the percentage-based, so if, you know, paper manufacturing uses a lot more less than 100 degree heating than chemicals manufacturing, or vice versa, the absolute amounts won't be the same.

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02:09:37.130 --> 02:09:43.219

Jonathan Margoliash: I will say that these assumptions are conservative. We are assuming

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02:09:43.280 --> 02:09:57.940

Jonathan Margoliash: that, less than 100 degrees C... less than 100 degrees C heating, maxes out at about 22.5% electrification by 2050, and that between 100 and 200 degrees C electrification,

862

02:09:57.970 --> 02:10:09.429

Jonathan Margoliash: only electrifies at about 8% at 2050. We're also assuming that thermal energy, you know, greater than 200 degrees C does not electrify, that that is beyond the range of, plausible electrification.

863

02:10:09.920 --> 02:10:13.780

Jonathan Margoliash: Also note that

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02:10:14.240 --> 02:10:21.989

Jonathan Margoliash: the most of the, gas usage in the industrial sector does go to, greater than 200 degrees C.

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02:10:22.210 --> 02:10:23.780

Jonathan Margoliash: electrification.

866

02:10:24.220 --> 02:10:31.970

Jonathan Margoliash: So... this is a... these rates are applied to a smaller subset of the gas usage of the industrial sector.

867

02:10:33.330 --> 02:10:34.840

Jonathan Margoliash: Next slide, please.

868

02:10:37.140 --> 02:10:48.669

Jonathan Margoliash: So to wrap up with the details, to get, the total gas abatement, we multiply the gas usage in each subsector, in each temperature band, by the electrification rate of that temperature band.

869

02:10:48.670 --> 02:10:59.250

Jonathan Margoliash: And then to get the electrification, we multiply that by the conversion factor for that temperature band. And that gets realized electrification, and you can sum that across temperature bands and across subsectors.

870

02:11:00.670 --> 02:11:01.650

Jonathan Margoliash: Next slide.

871

02:11:02.140 --> 02:11:07.400

Jonathan Margoliash: So that's the detail of our modeling. I want to talk about some plans for future forecast cycles. Next slide, please.

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02:11:09.360 --> 02:11:20.439

Jonathan Margoliash: So we wanted, you know, we are interested in doing a lot more research in these coming forecast cycles to help us narrow down the, uncertainty in these forecasting assumptions.

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02:11:20.580 --> 02:11:28.219

Jonathan Margoliash: We want to do continued research into assumptions about industrial heat pump readiness at different temperature bands.

874

02:11:28.230 --> 02:11:43.110

Jonathan Margoliash: We want to look into the economics of electrification, both industry-wide, but also for different subsectors, and even for different facilities, and we want to see how, policies, you know, potential policy impacts of that might, might change that economic outlook.

875

02:11:43.240 --> 02:11:58.890

Jonathan Margoliash: We want to look into agricultural fuel substitution, in addition to industrial fuel substitution. And we want to look into, not listed here, but we want to look into thermal batteries as well as a potential technology for industrial electrification.

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02:11:59.210 --> 02:12:09.199

Jonathan Margoliash: We want to improve our data. We want to better characterize what percentage of gas is used in each subsector for each temperature range of thermal electrification.

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02:12:09.380 --> 02:12:14.210

Jonathan Margoliash: And we want to do better at tracking the electrification that's already occurring.

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02:12:15.220 --> 02:12:30.830

Jonathan Margoliash: And then we want to, you know, follow along with, existing and future industrial electrification trends. We know that the South Coast Air Quality Management District has recent regulation and proposed regulations for boilers and heaters in its district that might affect industry in its district.

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02:12:31.090 --> 02:12:45.030

Jonathan Margoliash: We know that there's been a, announced, concentrated solar thermal plant in the Searles Valley at a boron mine there, which would provide more than 200 degrees C temperature heating there.

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02:12:45.450 --> 02:12:52.220

Jonathan Margoliash: And we know that there's existing CEC-sponsored industrial electrification projects around the state, especially in the dairy industry.

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02:12:52.710 --> 02:13:05.360

Jonathan Margoliash: And with all this data, if the data suggests it, we would consider expanding our modeling to beyond just AAFS6 to different AAFS scenarios, if the data warrants it.

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02:13:06.130 --> 02:13:07.679

Jonathan Margoliash: Next slide, please.

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02:13:08.820 --> 02:13:10.610

Jonathan Margoliash: So that said,

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02:13:10.720 --> 02:13:21.299

Jonathan Margoliash: We would love your input. If you have insights or data that can help our modeling, help us characterize these scenarios and reduce the uncertainty that we're working with here, please do share. That would improve our work.

885

02:13:21.700 --> 02:13:22.790

Jonathan Margoliash: Next slide.

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02:13:24.150 --> 02:13:38.650

Jonathan Margoliash: So you can always email me, my email address is below, you can email my bosses, you can leave a comment here in this workshop, or on the docket of this workshop, any of these are great ways to get a hold of that. With that said, thank you to my team, thank you for listening, and happy to take questions.

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02:13:45.370 --> 02:13:51.749

Commissioner Andrew McAllister: Great, well, thanks, Ethan and Jonathan. Great job.

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02:13:52.140 --> 02:14:02.209

Commissioner Andrew McAllister: let's see, I do have a couple of questions, and we'll also invite Qing to come on as well, if you have questions, Qing, but

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02:14:02.880 --> 02:14:06.590

Commissioner Andrew McAllister: Let's see, I wanted to...

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02:14:07.010 --> 02:14:13.459

Commissioner Andrew McAllister: maybe I'll just jump in here. So, Ethan, on your... I really appreciate, you know, your,

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02:14:14.500 --> 02:14:29.430

Commissioner Andrew McAllister: the energy efficiency space. It's kind of uniquely granular, and so, you know, the scenarios really matter, because it's aggregating a lot of smaller pieces of equipment across the state. And you mentioned, the 1.6 million number

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02:14:29.490 --> 02:14:38.430

Commissioner Andrew McAllister: Of, I think it was, retrofits, space and water heaters in existing buildings per year? Existing buildings.

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02:14:38.430 --> 02:14:39.000

Ethan Cooper: Yeah.

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02:14:39.370 --> 02:14:51.610

Commissioner Andrew McAllister: And, so, so, and I think, you know, we're seeing really good development in, at least in the HVAC side, that, heat pumps are outselling furnaces, actually, over the last year or two.

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02:14:51.920 --> 02:14:58.320

Commissioner Andrew McAllister: Which would suggest that, you know, at least to the extent that part of the \$1.6 million is HVAC.

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02:14:58.650 --> 02:15:05.250

Commissioner Andrew McAllister: you know, more than half of those are now kind of... the furnace replacements are turning into heat pumps. It seems like that... that gives us

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02:15:05.540 --> 02:15:08.330

Commissioner Andrew McAllister: Gives us some... a fighting chance of getting to 6 million.

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02:15:08.600 --> 02:15:21.490

Commissioner Andrew McAllister: By 2030, right? Only a few years left there, but... but still, that's, those are big numbers. I'm wondering, do you sort of have any scenarios about sort of looking at, okay, market penetration, you know, if we really... I mean, a market, like.

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02:15:21.650 --> 02:15:34.959

Commissioner Andrew McAllister: takes a long time to transform, you know, and it's slow until it's not, right? And then all of a sudden, it sort of becomes the obvious thing to do, and

the numbers get big pretty quick. Like, that's kind of the hockey stick that we see across numerous technologies. I'm wondering, sort of, have you thought about that?

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02:15:35.210 --> 02:15:39.830

Commissioner Andrew McAllister: You know, what a true market transformation, sort of the next couple few years.

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02:15:40.110 --> 02:15:48.830

Commissioner Andrew McAllister: would look like, I mean, I think about the 6 million heat pump goal, but it's also, you know, its impact on the forecast.

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02:15:48.990 --> 02:15:54.600

Commissioner Andrew McAllister: Seems like a high-end scenario there, and it's captured by one of your scenarios. Maybe you could just talk through that more specifically.

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02:15:54.600 --> 02:16:03.059

Ethan Cooper: Yeah, and for the, the number that I mentioned earlier, the 1.6 million, that was, like, what would happen if, starting in 2026, everybody

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02:16:03.080 --> 02:16:18.390

Ethan Cooper: In new homes only put in a heat pump water heater and heat pump space heater. Same thing if you retrofitted your building, or if you had an appliance burning out,

you only would be putting in heat pumps, but kind of our gradual transformation are more on the lines of, like, what might happen if we gradually transition to

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02:16:18.390 --> 02:16:30.039

Ethan Cooper: Each year, more people are going to be replacing their burned-out gas furnace with the water heater, or sorry, with the heat pump water heater and heat pump space heater if their HVAC system burns out. So that's kind of what we're trying to capture.

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02:16:30.090 --> 02:16:38.120

Ethan Cooper: What might be, like, the lower ends of not as much adoption happening, like, you're not getting to that 100% replaced on burnout by 2030, but maybe it happens...

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02:16:38.250 --> 02:16:53.510

Ethan Cooper: by 2040, or maybe it doesn't happen, like, maybe you get 50% by 2040. So those are kind of the ones, like, the lower ends, what might be happening in lieu of, like, any major policies, like, what could be the general transition into more people adopting or installing heat pumps rather than

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02:16:53.760 --> 02:16:56.870

Ethan Cooper: Replacing their gas furnace or gas water heater with another gas appliance.

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02:16:56.879 --> 02:17:10.589

Commissioner Andrew McAllister: Yeah, yeah. I mean, I guess I would say, I think on the HVAC side, we're probably gonna be more aggressive than that conservative, than that sort of middling assumption, because it seems like that's already kind of flipping to the majority, even in retrofits, being

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02:17:11.119 --> 02:17:20.319

Commissioner Andrew McAllister: being heat furnaces replaced with heat pumps. So that seems like a place where we might be kind of a little bit ahead of the game, you know, fingers crossed, you know, knock on wood.

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02:17:20.579 --> 02:17:28.579

Commissioner Andrew McAllister: And then on the water heater side, adoption seems to be slower for, you know, a bunch of different reasons, but, you know, really, it'd be nice to...

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02:17:28.829 --> 02:17:34.729

Commissioner Andrew McAllister: Sort of lay out some kind of a scenario, or sort of map one of your scenarios onto, like, hey, yeah, this...

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02:17:35.229 --> 02:17:46.619

Commissioner Andrew McAllister: trajectory does actually meet the 6 million heat pump goal, and just sort of see how far off we are. What would need to happen in order for us to meet that policy goal? It's always nice to kind of calibrate to the policy.

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02:17:46.949 --> 02:17:57.029

Commissioner Andrew McAllister: And sort of, you know, what could go right, right, kind of thing. So just would encourage a little, a little deeper dive on that, maybe. And

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02:17:57.429 --> 02:18:02.579

Commissioner Andrew McAllister: Let's see... And then I also wanted to understand,

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02:18:02.899 --> 02:18:13.209

Commissioner Andrew McAllister: I guess, we're... the efficiency division's been working with the PUC to get... I think... I think the forecasting team, too, to get an understanding of what,

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02:18:13.569 --> 02:18:23.829

Commissioner Andrew McAllister: new construction looks like in terms of, you know, the new policies, new-ish policies, you know, a few years old now at the PUC are starting to take an effect where

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02:18:23.989 --> 02:18:29.579

Commissioner Andrew McAllister: Developers cannot rate-based against socialized costs for the infrastructure development that goes into new

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02:18:29.689 --> 02:18:36.699

Commissioner Andrew McAllister: large-scale developments, like production builds, right? So they can't, or if they want to build dual-fuel homes.

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02:18:37.029 --> 02:18:42.389

Commissioner Andrew McAllister: They can't socialize the cost of the electric and gas infrastructure going into that new development.

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02:18:42.499 --> 02:18:57.649

Commissioner Andrew McAllister: So that's a big motivator, and I think we're hearing, you know, that 80-plus percent of new construction, single-family at least, is, is now all electric. And that number's, you know, getting pretty com... pretty, pretty, high, ever higher, right?

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02:18:57.779 --> 02:19:06.269

Commissioner Andrew McAllister: So, I wonder how... you might have said that, and I might have missed it, but what...

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02:19:06.369 --> 02:19:08.689

Commissioner Andrew McAllister: Scenarios are sort of capturing

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02:19:08.889 --> 02:19:15.389

Commissioner Andrew McAllister: That also kind of, you know, maybe above what we might have expected a few years ago, penetration of heat pumps in new builds.

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02:19:15.770 --> 02:19:22.950

Ethan Cooper: Yeah, that would be, like, new construction, anything that could still be done with FSSAT modeling is in scenarios 4 through 6.

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02:19:22.959 --> 02:19:24.249

Commissioner Andrew McAllister: 4th or 6, okay. But...

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02:19:24.250 --> 02:19:40.999

Ethan Cooper: Some of that could also be included in our PICS Title 24 impacts, or just our PICS modeling in general, too. We have a lot of new construction kind of focused in that section as well, like, that's where most of it would be happening, and then anything that could still potentially happen would occur in our ZE fuel substitution modeling for FSSAT.

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02:19:41.320 --> 02:19:47.020

Commissioner Andrew McAllister: Okay, so maybe the FSAT numbers, sort of, the FSAT

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02:19:47.139 --> 02:19:55.639

Commissioner Andrew McAllister: factors, really, for heat pump penetration and new construction. Hopefully those are aligned with where we think the marketplace actually is and is going.

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02:19:55.740 --> 02:19:58.669

Commissioner Andrew McAllister: Yeah. But, presumably, you guys are making... closing that loop.

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02:19:59.780 --> 02:20:04.300

Commissioner Andrew McAllister: Great, okay, terrific. And then,

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02:20:05.020 --> 02:20:11.870

Commissioner Andrew McAllister: I had a couple... let's see, yeah, a couple questions, for you, Jonathan.

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02:20:12.140 --> 02:20:14.109

Commissioner Andrew McAllister: Thanks a lot, Ethan, really appreciate that.

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02:20:14.690 --> 02:20:18.740

Commissioner Andrew McAllister: So, industrial, obviously, super important.

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02:20:18.870 --> 02:20:21.970

Commissioner Andrew McAllister: Just... I mean...

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02:20:22.120 --> 02:20:35.379

Commissioner Andrew McAllister: we're not going to get to zero if we don't figure out how to deal with all those molecules, you know, all those fossil molecules. And so, some of them will stay molecules, you know, hydrogen and the like. A lot of them have to go over to electrons, and, you know, you talked about the

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02:20:35.540 --> 02:20:39.690

Commissioner Andrew McAllister: Lower, lower heat, and then, sort of middling heat, and then the, you know.

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02:20:39.830 --> 02:20:45.419

Commissioner Andrew McAllister: that the high heat applications are still, you know, kind of, bespoke and TBD.

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02:20:45.960 --> 02:20:54.429

Commissioner Andrew McAllister: So lots of... really appreciate all the, you know, need for desegregation by end use, and really, you know, the future direction that you mentioned, totally agree that

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02:20:54.760 --> 02:21:02.460

Commissioner Andrew McAllister: Gotta get a handle on, you know, the sort of the volume or the scale of each type of end use.

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02:21:02.620 --> 02:21:05.940

Commissioner Andrew McAllister: Really drill into that, so totally support that effort.

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02:21:06.270 --> 02:21:12.070

Commissioner Andrew McAllister: So... I guess the,

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02:21:13.090 --> 02:21:19.819

Commissioner Andrew McAllister: You know, it seems like there's a really important nexus between the work that you're doing and the forecast

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02:21:20.100 --> 02:21:22.070

Commissioner Andrew McAllister: And the policy side.

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02:21:24.000 --> 02:21:32.020

Commissioner Andrew McAllister: And so I wonder, you know, how you think about, well, for example, like, with high... with high heat, with high temperature applications.

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02:21:32.450 --> 02:21:37.569

Commissioner Andrew McAllister: You know, that's a lot of power that would go into these thermal batteries that would then be able to

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02:21:37.990 --> 02:21:44.209

Commissioner Andrew McAllister: You know, the RDD, the R&D division has been doing some, you know, really interesting work.

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02:21:44.380 --> 02:21:46.620

Commissioner Andrew McAllister: With a few companies around high temp.

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02:21:46.800 --> 02:21:50.229

Commissioner Andrew McAllister: store... thermal storage, where that... that...

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02:21:50.380 --> 02:21:54.330

Commissioner Andrew McAllister: It's, you know, its role as a stabilizing factor

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02:21:54.550 --> 02:22:03.549

Commissioner Andrew McAllister: In the grid, just as a large load, and then an offloading of large, or sort of supplying large thermal

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02:22:03.720 --> 02:22:07.279

Commissioner Andrew McAllister: In the process, this just seems super, super important.

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02:22:07.510 --> 02:22:09.020

Commissioner Andrew McAllister: But, there are...

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02:22:09.140 --> 02:22:14.519

Commissioner Andrew McAllister: Again, there's sort of, like, levers that have to be pulled to help realize that... that technical potential.

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02:22:15.010 --> 02:22:32.779

Commissioner Andrew McAllister: So kind of wondering, you know, how does the forecasting team think about that in terms of scenarios? Like, you know, you sort of... I'm blathering here, but you sort of, you know, above 200 degrees, you know, you sort of said, well, that's sort of TBD, and it's a little bit nebulous.

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02:22:33.180 --> 02:22:47.340

Commissioner Andrew McAllister: But it could come into focus with the right policy, the thing. So I guess I'm just kind of wondering how the... and Quentin, I see you coming on, so that's great. You know, how that interaction between, you know, what the current state of technology

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02:22:47.490 --> 02:22:52.470

Commissioner Andrew McAllister: And possibilities for those high heat loads, which are, you know, there's a lot of energy there.

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02:22:54.100 --> 02:23:02.620

Commissioner Andrew McAllister: And so... and therefore, you know, a lot of emissions and a lot of molecules. And so, like, converting those to electricity just seems like almost job one.

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02:23:02.840 --> 02:23:07.679

Commissioner Andrew McAllister: for the industrial sector. So, I guess, how are we thinking about

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02:23:07.940 --> 02:23:13.840

Commissioner Andrew McAllister: You know, getting a handle on what policies we could be helpful in detailing or sort of elucidating.

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02:23:13.990 --> 02:23:19.159

Commissioner Andrew McAllister: Based on the forecasting work and the market assessment that the team has been doing.

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02:23:22.060 --> 02:23:23.649

Jonathan Margoliash: Quentin, do you want to take this first?

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02:23:24.480 --> 02:23:28.860

Quentin Gee: Jonathan, do you have any thoughts? I can... I can follow up with anything else.

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02:23:28.860 --> 02:23:29.380

Jonathan Margoliash: Sure.

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02:23:30.100 --> 02:23:33.269

Jonathan Margoliash: Thank you for your question, Commissioner.

Commissioner McAllister: You bet.

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02:23:34.050 --> 02:23:44.290

Jonathan Margoliash: The... yes, it's... it is a, like, the prime space, like, if we could tar... if this could be targeted, that would have the biggest impact in the industrial sector.

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02:23:44.550 --> 02:23:46.310

Jonathan Margoliash: That's very important there.

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02:23:48.080 --> 02:23:55.919

Jonathan Margoliash: And, like, modeling for next year and, like, really drilling down into that is, you know, something we haven't started on yet, you know.

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02:23:56.320 --> 02:24:01.460

Jonathan Margoliash: for next year's cycle, so I don't have any, like, definite answers as to how we're planning on incorporating this in the forecast.

Commissioner McAllister: for sure.

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02:24:01.630 --> 02:24:06.060

Jonathan Margoliash: I think maybe key considerations are...

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02:24:06.060 --> 02:24:25.620

Jonathan Margoliash: Like, one is the, you know, the price of electricity, and the industrial... like, and heat pumps have very high, coefficients of performance at lower temperatures, but currently don't have those benefits, to my knowledge, at, higher temperatures, and so you're getting more... closer to.

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02:24:25.620 --> 02:24:34.179

Jonathan Margoliash: like, the one-to-one, comparison between, cost per unit of energy, between electricity and gas. And so, to the extent that,

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02:24:34.230 --> 02:24:38.639

Jonathan Margoliash: You know, policies that can affect that, you know, that spark gap.

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02:24:38.730 --> 02:24:58.189

Jonathan Margoliash: That is a place that policy, would play a role. There's also, of course, the policy impact of just getting these technologies deployed, and, like, making people, industry feel comfortable that these are things that, that work, are reliable, would be easy to install.

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02:24:58.380 --> 02:25:01.020

Jonathan Margoliash: Those are all key players.

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02:25:01.150 --> 02:25:02.710

Jonathan Margoliash: I think...

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02:25:02.820 --> 02:25:18.099

Jonathan Margoliash: there's also, a question of, behind-the-meter energy, I think, here, that does change the cost equation, because then you're, only paying for the cost of the generation and the,

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02:25:18.190 --> 02:25:32.719

Jonathan Margoliash: and the generating equipment itself, and not for the cost of the wires, and so that can really change, the equation, and then that focuses more on the technology as opposed to the cost of the transmission that goes into the grid. So that's, I think, would...

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02:25:32.810 --> 02:25:46.739

Jonathan Margoliash: is more... is plausible that that could be a different, area of electrification than, facilities simply consuming electricity for the grid, for these, let's say, high-heat batteries or other potential.

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02:25:46.740 --> 02:25:47.940

Commissioner Andrew McAllister: Yeah, exactly.

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02:25:48.050 --> 02:25:55.980

Commissioner Andrew McAllister: Interesting. I mean, Lynn talked about, you know, the outset of today's session, just that...

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02:25:56.370 --> 02:26:08.419

Commissioner Andrew McAllister: you know, it's not... it's more a matter of, sort of, having the capacity available when you need it, you know, less about the, sort of, absolute just bulk energy, necessarily. And I think, you know, we have a... with all the build out of solar, we've got a lot of

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02:26:08.650 --> 02:26:19.560

Commissioner Andrew McAllister: We have a number of hours throughout the year where we have a lot... we do have a lot of cheap, solar that, you know, will go to other states, or it'll be curtailed, but, you know, trying to sort of look for good places to send that energy

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02:26:19.870 --> 02:26:31.469

Commissioner Andrew McAllister: And these high heat... these high temp, thermal batteries. And there's, you know, I mean, there's some so cool technologies you're all aware of, but just sort of thermochemical, electrical, you know, sort of at that nexus.

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02:26:31.650 --> 02:26:47.130

Commissioner Andrew McAllister: And, you know, I won't name the companies, but I think, you know, interconnection at the transmission level to really offload a lot of cheap power to get high heat, and then have an industrial off-taker for that nearby seems like a hugely attractive, area.

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02:26:47.270 --> 02:26:50.470

Commissioner Andrew McAllister: And if we could kind of unlock that, then that would be...

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02:26:50.590 --> 02:26:57.430

Commissioner Andrew McAllister: You know, but it's at transmission, so it's interconnection, it's got a FERC component, you know, all that. So, like, that's what I'm kind of getting at with this policy regime.

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02:26:57.560 --> 02:27:00.840

Commissioner Andrew McAllister: It's tricky, but, boy, it seems like there's a lot of potential.

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02:27:01.320 --> 02:27:06.389

Commissioner Andrew McAllister: And the forecast could really help elucidate, right? If, you know, as we were talking about.

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02:27:06.830 --> 02:27:14.640

Commissioner Andrew McAllister: Mapping to actually the, you know, the actualities of what the grid we have looks like, and where the points of potential interconnection are, and

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02:27:15.190 --> 02:27:21.360

Commissioner Andrew McAllister: you know, really mapping that out. Boy, it seems like that could be a hugely useful resource to help policy evolve and be sensible.

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02:27:23.600 --> 02:27:39.680

Quentin Gee: Yeah, Commissioner... oh, yeah, I was gonna say, Jonathan just started in the Efficiency Analysis Unit team, and I think these are some of the areas that he's really excited to dig into further. But, you know, we've already had some initial conversations about this, and we're...

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02:27:39.680 --> 02:28:03.729

Quentin Gee: We're really excited. I think that, yeah, I think you're right that some of the fundamentals here are just kind of speak for themselves, given the relatively low levelized cost of things like solar. And like you're mentioning here, sometimes, you know, you can get these really low prices at the transmission level, even if you're interconnected. But certainly behind the meter, there's opportunities for that.

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02:28:04.810 --> 02:28:16.200

Quentin Gee: With these low costs, overall, you are looking at a fundamental sort of basis. Thermal energy could, in fact, be cheaper than some of the gas rates out there.

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02:28:16.250 --> 02:28:24.380

Quentin Gee: you have to get a system in place that would then allow you to off-take, store, and those other sorts of things. So, at this point in time.

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02:28:24.380 --> 02:28:48.349

Quentin Gee: We are... we kind of left that out of the equation, but it's something that we're excited to look forward to, and yeah, like I said, Jonathan and I have already begun some conversations on this, and I think we're looking forward to seeing where it can play out, and also looking into some of the policy drivers, but yeah, we want to be in touch with the Research and Development Division here at the CEC to learn more about the progress there.

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02:28:48.350 --> 02:29:06.889

Quentin Gee: But the fundamentals, I would say, are kind of there in a really important way, and I think that we want to just continue working that through, say, the demand scenarios, but then also where it starts... we start to see the market unfolding a little bit more tangibly, we'll be looking into integrating into the forecast.

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02:29:06.890 --> 02:29:16.319

Commissioner Andrew McAllister: Yeah, fantastic, fantastic. We want those industries to stay in California, we want... we want it to be clean, and I think they, you know, many, most of them, I would say, want to be clean.

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02:29:16.560 --> 02:29:28.869

Commissioner Andrew McAllister: So, I feel like there, you know, there's a huge potential for positive, kind of, collaborations there, and we already have inroads, you know, through what you're doing and assessing industries and the RDD vision.

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02:29:29.120 --> 02:29:35.019

Commissioner Andrew McAllister: So a lot of... a lot of... I think we have... the Energy Commission has the, kind of.

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02:29:35.380 --> 02:29:45.709

Commissioner Andrew McAllister: the right kind of conditions to really lead on... on this issue, and it's a nut that's been hard to crack, right? We have... heavy industry is just a... it's a global marketplace for these commodities.

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02:29:46.140 --> 02:29:48.010

Commissioner Andrew McAllister: You know, and,

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02:29:48.190 --> 02:29:55.960

Commissioner Andrew McAllister: And so, you know, it's hard to kind of get there, get attention, and get focus, and get investment.

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02:29:56.240 --> 02:30:01.740

Commissioner Andrew McAllister: When, you know, we're a unique jurisdiction that does have some cost drivers, and so...

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02:30:01.860 --> 02:30:05.860

Commissioner Andrew McAllister: I think unlocking these benefits could really help the state in a big, big way.

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02:30:06.050 --> 02:30:16.179

Commissioner Andrew McAllister: But, anyway, I'll get off my soapbox, but I'm super excited about this as well, you can tell, because, industrial... I used to work on the industrial... in the industrial space, and,

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02:30:16.540 --> 02:30:27.950

Commissioner Andrew McAllister: And just kind of, you know, the way they... I mean, they're very diverse, but... but I think that, you know, very sharp pencils in terms of investment, and... and how... and, you know, commodity price, and...

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02:30:28.330 --> 02:30:38.670

Commissioner Andrew McAllister: global marketplaces. So, I think, you know, and also down along the border, on both sides of the border, on the Mexican side of the border, too, I think we have a lot of similar kind of issues, and so...

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02:30:38.930 --> 02:30:44.980

Commissioner Andrew McAllister: I think these solutions could definitely go beyond California's borders if the global marketplace

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02:30:45.100 --> 02:30:52.990

Commissioner Andrew McAllister: kind of increasingly values cleanliness, right? Which it is, somewhat, so...

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02:30:52.990 --> 02:30:53.570

Quentin Gee: I'm glad you mentioned it. Because that's...

1012

02:30:53.570 --> 02:30:54.090

Commissioner Andrew McAllister: Yeah.

1013

02:30:54.090 --> 02:30:55.560

Quentin Gee: Right where we were headed.

1014

02:30:55.560 --> 02:30:55.890

Commissioner Andrew McAllister: Mr.

1015

02:30:55.890 --> 02:30:56.300

Quentin Gee: where we're.

1016

02:30:56.300 --> 02:30:56.830

Commissioner Andrew McAllister: Great.

1017

02:30:56.830 --> 02:30:57.190

Quentin Gee: Yeah.

1018

02:30:57.190 --> 02:31:00.930

Commissioner Andrew McAllister: I think California, again, I think California's brand could be very, very powerful.

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02:31:01.120 --> 02:31:04.879

Commissioner Andrew McAllister: In pushing solutions forward in the industrial sector.

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02:31:04.880 --> 02:31:05.300

Quentin Gee: Right.

1021

02:31:05.300 --> 02:31:08.579

Commissioner Andrew McAllister: So, yeah, love, love, love to be working on that with y'all.

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02:31:08.730 --> 02:31:13.099

Commissioner Andrew McAllister: Sorry, Qing, I've gone on too long here. Go ahead.

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02:31:13.490 --> 02:31:22.180

Qing Tian: No, no, thank you, Commissioner. I really appreciate the discussion. I don't have... I don't have too much to add, just...

1024

02:31:22.580 --> 02:31:27.210

Qing Tian: Maybe, like, something... this is, like, in my mind, like, you know, the...

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02:31:27.970 --> 02:31:36.609

Qing Tian: It is, like, very excited to see, like, we have more heat pumps, in the system. I think this...

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02:31:36.810 --> 02:31:46.160

Qing Tian: kind of question probably applies for both, topics, because for me, like, I'm really curious about historical data, you know, how we can

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02:31:46.340 --> 02:31:51.879

Qing Tian: You know, leverage, you know, the historical data and direct inputs.

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02:31:52.040 --> 02:31:57.000

Qing Tian: You know, to help inform our scenario planning.

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02:31:57.190 --> 02:32:00.030

Qing Tian: You know, one example could be, like, you know, we have

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02:32:00.130 --> 02:32:10.839

Qing Tian: a lot of, like, heat pumps, in the market, you know, already. How we can use those to help further improve our, you know, modeling.

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02:32:10.920 --> 02:32:25.260

Qing Tian: And same thing, like, you know, for the industrial electrification, I'm wondering, like, you know, whether there's any, like, survey data out there to help us look into, you know, what kind of application, you know, currently, you know, exist?

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02:32:25.260 --> 02:32:33.720

Qing Tian: What is the temperature requirement, or what's the potential? So, but anyway, is there anything... if you have anything to comment on those?

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02:32:33.870 --> 02:32:38.730

Qing Tian: I welcome. Otherwise, I think we can do a follow-up later on, so...

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02:32:40.150 --> 02:32:43.779

Jonathan Margoliash: Happy to briefly, thank you for the question, Qing

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02:32:46.140 --> 02:32:55.829

Jonathan Margoliash: Yes, so I think the adoption in the industrial space is relatively nascent at this point, but I don't think we're going to see

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02:32:56.070 --> 02:32:58.230

Jonathan Margoliash: Huge data sets that, like.

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02:32:58.500 --> 02:33:09.309

Jonathan Margoliash: can really, like, fully describe trajectories out into the future. But still, there is some adoption, and I think, like, our interval metering data can help us

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02:33:09.450 --> 02:33:25.779

Jonathan Margoliash: identify where the adoption is taking place in California. We know that there's existing, you know, pilot programs out of the Energy Commission that we can look to for how these things are working. We know, you know, some industrial heat pump manufacturers have announced pilots

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02:33:25.860 --> 02:33:34.940

Jonathan Margoliash: And so we can look to the publicly available data about how those are working and, you know, what temperature ranges they're working, and how that's working for those facilities.

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02:33:35.140 --> 02:33:42.880

Jonathan Margoliash: So yeah, this is definitely, thank you for highlighting this. I agree, this is something to focus on in the next year to help us

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02:33:42.990 --> 02:33:55.899

Jonathan Margoliash: you know, characterize, like, what is... what is the current scenario? Like, where are we at, both as an industry-wide, but also specifically in California? Like, where has... what progress has already been made? I think there's...

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02:33:56.240 --> 02:33:57.559

Jonathan Margoliash: a lot to be gained there.

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02:33:59.050 --> 02:34:19.049

Ethan Cooper: Yeah, I think just to add on to that for, like, the residential and commercial side, definitely being able to utilize different, you know, our AMI data sources to go try to go use that to create methodologies to go see through different IOUs, how can we best track what homes through that data do have AMI to the best level of confidence that we have.

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02:34:19.240 --> 02:34:27.250

Ethan Cooper: And then also being able to maybe expand out with different surveys, like the RASS survey, to be able to ask certain questions on, like, what kind of heat pump, what kind of...

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02:34:27.710 --> 02:34:40.249

Ethan Cooper: HVAC system or water heating system do you have? Is it a heat pump or electric resistance for water heating? Kind of go get an idea of what homes do have heat pumps within them right now, and also an idea of where are those spread out geographically.

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02:34:40.250 --> 02:34:48.520

Ethan Cooper: like, what building climate zones do they have? Because if it's more within, like, the Central Valley area, probably could be a lot more AC usage there than if you're on

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02:34:48.540 --> 02:34:51.189

Ethan Cooper: you know, the coast, like in the Bay Area.

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02:34:52.150 --> 02:35:08.059

Ethan Cooper: That's one avenue we definitely want to look into more on the tracking on the residential and commercial side as well. And also, the heat pump tracking... the heat pump partnership is a good place as well to see, like, programmatically, where are we right now, and kind of how are we projecting out into the next 5 plus years.

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02:35:09.930 --> 02:35:10.620

Qing Tian: Wonderful.

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02:35:10.940 --> 02:35:11.610

Qing Tian: Thanks.

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02:35:13.080 --> 02:35:15.180

Commissioner Andrew McAllister: Great, yeah, really glad you're,

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02:35:15.590 --> 02:35:17.830

Commissioner Andrew McAllister: You know, working... working in that kind of...

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02:35:18.130 --> 02:35:28.130

Commissioner Andrew McAllister: cross-division matrix, trying to unlock the AMI resource. That data really, I think, is important. And also, I think you mentioned, Jonathan, the,

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02:35:29.500 --> 02:35:38.250

Commissioner Andrew McAllister: But, I think it applies to both of you, actually, that on the residential side, we have the Equitable Building Decarbonization Program that's rolling out, so we're going to have all these participants.

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02:35:38.640 --> 02:35:43.730

Commissioner Andrew McAllister: You know, thousands of participants who are going to be installing heat pumps of one flavor or another.

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02:35:44.000 --> 02:35:51.099

Commissioner Andrew McAllister: And we can look at the sort of trends. You know, once we have a, you know, large enough sample, we can sort of really look at

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02:35:51.210 --> 02:35:57.060

Commissioner Andrew McAllister: what's driving the load shapes, and how heat pumps appear in those load shapes, right? And sort of...

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02:35:57.180 --> 02:36:11.129

Commissioner Andrew McAllister: be much more, sort of targeted with the analysis to understand where heat pumps... what that footprint looks like more broadly, right? And so, suss out what... what buildings already have heat pumps. So that... those methodologies, I think, were going to get a lot of juice

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02:36:11.330 --> 02:36:12.800

Commissioner Andrew McAllister: Out of the squeeze there.

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02:36:14.480 --> 02:36:15.600

Commissioner Andrew McAllister: Good stuff.

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02:36:16.340 --> 02:36:22.239

Commissioner Andrew McAllister: Great. Well, I don't have any other questions. I know I wanted to thank, actually.

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02:36:22.430 --> 02:36:30.189

Commissioner Andrew McAllister: Jesse and Alex for moderating the Q&A, online there, and... I think...

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02:36:30.290 --> 02:36:44.540

Commissioner Andrew McAllister: pass it back. Thanks to Jonathan, Ethan, great job. Really appreciate your work. Thank you. Thanks to the teams. And pass it back to Sandra, and we can start on the, the Q&A, the public comments.

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02:36:45.200 --> 02:36:50.510

Sandra Nakagawa: Alrighty, thank you so much, thanks to all of our presenters, thanks to the dais as well.

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02:36:50.690 --> 02:36:59.569

Sandra Nakagawa: Before we move on to our public comment period, we do have one outstanding question in the Zoom Q&A.

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02:36:59.790 --> 02:37:19.520

Sandra Nakagawa: From Claire Broome about the Title 201304B, and whether it's showing the same decreased rate of new installs and applications for POUs as IOUs. We'll see if there's anybody on the team who's able to answer that now, or we can type the answer, into the Zoom question there for, Claire.

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02:37:20.690 --> 02:37:22.720

Sandra Nakagawa: And while we're doing... yeah, great.

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02:37:22.720 --> 02:37:33.469

Alex Lonsdale: This is Alex Lonsdale, Distributed Generation Forecast Supervisor and in the Energy Assessments Division. Been fielding some questions about the interconnection data, so I just wanted to pop on and provide some clarifications here.

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02:37:33.470 --> 02:37:45.160

Alex Lonsdale: So just to clarify, any charts that we refer to Title 20, 1304B data, that is actual interconnection data, so it refers to interconnected energy systems on the distribution systems for each utility.

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02:37:45.380 --> 02:37:48.390

Alex Lonsdale: So, we don't have applications visibility.

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02:37:48.520 --> 02:38:00.370

Alex Lonsdale: for utilities that don't submit data directly to CEC, we rely on DGStats applications data to monitor current trends in application volumes for behind-the-meter PDN storage. And so.

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02:38:00.510 --> 02:38:13.689

Alex Lonsdale: that is in part why our charts on application volumes are limited to IOUs, because we rely on that CPUC data. We do not have visibility into applications that are currently being submitted to public-owned utilities.

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02:38:13.950 --> 02:38:22.750

Alex Lonsdale: So just a clarification there. And then in terms of the trend, the decreased rate of installations or interconnections across POUs compared to IOUs.

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02:38:22.790 --> 02:38:38.160

Alex Lonsdale: I don't think we have any qualitative or quantitative decrease rates to highlight here today, but if you'd like more insights into interconnection trends on capacity, we'd be happy to follow up with you and encourage you to reach out to our team.

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02:38:39.070 --> 02:38:39.970

Alex Lonsdale: Thank you.

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02:38:40.360 --> 02:38:44.209

Sandra Nakagawa: Alright, thank you so much, Alex. We're gonna move on to our public comment period.

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02:38:44.420 --> 02:38:54.189

Sandra Nakagawa: So during this time, one person per organization may comment, and comments are limited to 3 minutes per speaker. We will not be able to respond to questions during public comment.

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02:38:54.290 --> 02:39:01.310

Sandra Nakagawa: The notice does provide information on how you can contact us if you do have any follow-up questions for our presenters today.

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02:39:01.440 --> 02:39:07.450

Sandra Nakagawa: So, at this time, if you would like to make a public comment, you can use the raise hand feature on Zoom.

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02:39:07.630 --> 02:39:24.569

Sandra Nakagawa: If you're calling in via phone, you would use, star 9 to raise your hand, and then star 6 to mute and unmute your phone line. We'll also need to unmute you from our end. So I'm first gonna turn to people on Zoom, so if you're on Zoom, please raise your hand at this time.

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02:39:24.800 --> 02:39:27.140

Sandra Nakagawa: If you would like to make a public comment?

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02:39:28.530 --> 02:39:33.790

Sandra Nakagawa: Alright, I'm seeing Martin Turock. Martin, I'm going to unmute your line.

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02:39:34.490 --> 02:39:48.570

Sandra Nakagawa: If it looks like, IEPR team, I'll need someone else to unmute Martin's line, and I'm gonna have a 3-minute timer that'll show in the upper right-hand corner. Martin, can you check to see if your sound is working?

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02:39:48.970 --> 02:39:50.059

Martin Turock: Can you hear me?

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02:39:50.200 --> 02:39:52.930

Sandra Nakagawa: We can hear you. Starting the timer, go ahead.

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02:39:52.930 --> 02:40:09.899

Martin Turock: Excellent. Well, good morning, I'm Marty Turock, currently a board member of Cleantech San Diego, formerly the Executive Director of the CEC's Scene Innovation Cluster, and I'd like to update you on my current top priority clean energy project, which is directly relevant to today's conversation.

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02:40:09.900 --> 02:40:26.509

Martin Turock: I'm mentoring a startup with a breakthrough technology and approach that could significantly increase both the additional achievable energy efficiency and fuel substitution of residential hot water heaters, which are the second highest residential load.

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02:40:26.510 --> 02:40:32.580

Martin Turock: They've got an affordable, next-generation, 1800-watt, 120-volt plug-in.

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02:40:32.580 --> 02:40:52.719

Martin Turock: induction water heater that has comparable installed cost to traditional gas and electric water heaters, 20% lower lifecycle cost, no knocks, no high GWP refrigerant, no 240 volt circuit upgrade, no compressors, no noise, and they have an embedded predictive AI control network

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02:40:52.720 --> 02:41:06.680

Martin Turock: that it can aggregate a VPP network of dispatchable thermal energy storage that can offer utilities reliable daily grid-enabled load shifting, not just communication protocols for DR or ELRP events.

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02:41:06.740 --> 02:41:11.539

Martin Turock: In the June submission to the CPUC, CalMTA

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02:41:11.540 --> 02:41:36.400

Martin Turock: clearly stated in their executive summary that there's currently no solid value proposition for heat pump water heaters to replace gas water heaters. So, from my vantage point, this new 120-volt induction water heater is the only potential solution that actually offers an unsubsidized solution to all socioeconomic communities to decarbonize California's 8.8 million

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02:41:36.400 --> 02:41:59.870

Martin Turock: gas water heaters, which are 76% of the installed base. The problem is that the state and the DOE are currently establishing new standards and policies around one particular metric, UEF, Uniform Energy Factor, that favors heat pump water heaters, but can be inadequate and misleading because it does not consider multiple key elements

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02:41:59.870 --> 02:42:03.579

Martin Turock: That constitute a more comprehensive total system benefit metric.

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02:42:03.630 --> 02:42:25.099

Martin Turock: While this induction water heater does not meet the current DOE 2029 minimum standard, the unit actually provides significantly more hot water with lower total energy and peak power, greater than twice the hot water yield of electric resistance, greater than 5 times the hot water yield of gas water heaters.

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02:42:25.100 --> 02:42:29.999

Martin Turock: So, in the interest of true affordability and maximum total system benefit.

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02:42:30.000 --> 02:42:52.989

Martin Turock: for ratepayers and utilities, we urge the CEC, CPUC, CARB, and any other agencies or organizations that are establishing policies or stretch ordinances for hot water heater efficiency and fuel substitution to maintain a technology agnostic approach and specification metrics that do not favor one technology over another.

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02:42:52.990 --> 02:42:57.769

Martin Turock: So we hope you'll take this, this comment to heart.

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02:42:57.770 --> 02:43:06.570

Sandra Nakagawa: Thank you, we are at time. Thank you so much, Martin. I'm gonna see if anyone else would like to make public comment, so if you are on Zoom, you can use the raise hand feature.

1100

02:43:07.390 --> 02:43:08.899

Sandra Nakagawa: We'll give folks a minute.

1101

02:43:09.580 --> 02:43:16.989

Sandra Nakagawa: Not seeing anyone via phone, but if you do call in via phone, star 9 to raise your hand, star 6 to mute and unmute.

1102

02:43:21.170 --> 02:43:26.109

Sandra Nakagawa: Alrighty, Claire Broome, we are going to unmute your line and restart the timer here.

1103

02:43:27.420 --> 02:43:29.720

Sandra Nakagawa: Claire, can you test to see if your line is working?

1104

02:43:29.720 --> 02:43:31.219

Claire Broome: Sure, can you hear me?

1105

02:43:31.220 --> 02:43:33.779

Sandra Nakagawa: We can hear you loud and clear. I'm gonna start the timer now.

1106

02:43:33.780 --> 02:43:35.010

Claire Broome: Okay, thanks.

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02:43:35.280 --> 02:43:41.630

Claire Broome: Thank you for a fascinating and important morning, and...

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02:43:41.920 --> 02:43:44.639

Claire Broome: you know, as Yogi Berra might...

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02:43:45.250 --> 02:43:50.070

Claire Broome: emphasize we're dealing with a lot of uncertainty here.

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02:43:50.590 --> 02:43:55.199

Claire Broome: And... but it's really valuable to try to quantify that.

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02:43:55.400 --> 02:43:59.639

Claire Broome: The comments that I wanted to make are... are twofold.

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02:44:00.220 --> 02:44:07.350

Claire Broome: One, I really appreciated Commissioner McAllister's probing questions.

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02:44:07.410 --> 02:44:27.389

Claire Broome: Trying to surface the value of load flexibility as we face this enormous uncertainty about what is the load growth going to be, what is going to happen with revenue requirements and wildfire?

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02:44:27.390 --> 02:44:30.290

Claire Broome: Mitigation and liability.

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02:44:32.000 --> 02:44:47.659

Claire Broome: And so, as the Energy Commission wrestles with these difficult issues, I want to urge you all to highlight scenarios where you really look at what load flexibility

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02:44:47.790 --> 02:44:52.209

Claire Broome: Scenarios that emphasize load flexibility.

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02:44:52.950 --> 02:44:56.969

Claire Broome: very specifically, I think the issue of

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02:44:57.090 --> 02:45:12.490

Claire Broome: How much load flexibility could mitigate spending on distribution grid infrastructure is... is completely central, which... which you all recognized. But...

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02:45:12.700 --> 02:45:21.019

Claire Broome: as Lynn Marshall indicated, it's essentially masked when you have assumptions of load growth

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02:45:21.140 --> 02:45:37.679

Claire Broome: which may not materialize. So, thank you for that, and I look forward to your continued modeling, and also thinking about which scenarios you showcase for alternatives.

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02:45:37.750 --> 02:45:52.069

Claire Broome: The second comment I wanted to make is, I know the CEC is centrally involved in acquisition and presentation and availability of data on energy systems.

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02:45:52.070 --> 02:46:06.630

Claire Broome: And I just underline, the really important insights we're getting from the verdant analyses and the value of AMI data, as mentioned in the industrial applications.

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02:46:06.650 --> 02:46:17.380

Claire Broome: And hope that, We can continue to be creative about the kind of data access platform...

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02:46:17.620 --> 02:46:20.599

Claire Broome: that California would benefit from.

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02:46:20.750 --> 02:46:31.809

Claire Broome: And I'm not talking about publicly available data, I'm talking about, a secure platform for authorized users

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02:46:32.020 --> 02:46:39.740

Claire Broome: Which advances our ability to plan and implement the programs that we need.

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02:46:39.740 --> 02:46:40.320

Sandra Nakagawa: Great.

1128

02:46:40.320 --> 02:46:42.750

Claire Broome: affordable energy.

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02:46:42.750 --> 02:46:49.760

Sandra Nakagawa: Thank you, Claire, we are at time. I'm gonna see if there's anyone else who would like to make public comment. You can raise your hand on Zoom now.

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02:46:50.160 --> 02:46:53.009

Sandra Nakagawa: Or if you're calling in by phone, dial star 9.

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02:46:55.880 --> 02:47:11.830

Sandra Nakagawa: Alrighty, I'm not seeing any others. I will remind folks that we do welcome written comment. Those are due Tuesday, September 15th, and you can find

instructions on how to submit written comment on the workshop notice, which is available on the webpage for this workshop.

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02:47:12.260 --> 02:47:17.459

Sandra Nakagawa: With that, I'm going to turn it over to Commissioner McAllister for any closing remarks from the dais.

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02:47:18.730 --> 02:47:31.669

Commissioner Andrew McAllister: Thank you, Sandra. Great job, you and the team. Another really interesting, important workshop. And I learned a bunch, and just, it's great to have this snapshot of all the incredible work that's happening.

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02:47:31.970 --> 02:47:47.940

Commissioner Andrew McAllister: around the forecast, really grappling with the complex issues, which really are fundamental to getting it right. And I think, you know, I just highlight the relationships and the teamwork that happens, not just within the Energy Commission, but

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02:47:48.020 --> 02:47:55.540

Commissioner Andrew McAllister: You know, as we heard in each presentation, really, kind of triangulating and calibrating and sharing and comparing.

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02:47:55.740 --> 02:48:06.450

Commissioner Andrew McAllister: with the Air Resources Board and the Public Utilities Commission, the utilities, and technology providers, and just a host of other folks, including those engaged here, really thanks to

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02:48:06.660 --> 02:48:14.570

Commissioner Andrew McAllister: Claire and others for being, proactive with your questions. That really is very, very meaningful, and I think we had upwards of 100 or so people.

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02:48:14.870 --> 02:48:19.150

Commissioner Andrew McAllister: On the workshop today, so, that's great.

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02:48:19.260 --> 02:48:29.850

Commissioner Andrew McAllister: And, it's nice to have just that snapshot of, of the work and the directionality of the... and the questions that staff's asking and really trying to grapple with to get

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02:48:30.010 --> 02:48:42.149

Commissioner Andrew McAllister: You know, ever better answers to, as we build this forecast, and it's a complex landscape out there, it's constantly evolving, so that situational awareness is super important to maintain and develop.

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02:48:42.280 --> 02:48:50.850

Commissioner Andrew McAllister: And that curiosity really is fundamental, so appreciate all the presenters, and as well as the IEPR team. Sandra, a great job again to you and the IEPR team.

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02:48:51.000 --> 02:48:59.209

Commissioner Andrew McAllister: And, appreciated, Rajinder being on for the first part of the workshop, and... and also Qing. Qing, any comments to wrap us up?

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02:49:00.660 --> 02:49:08.239

Qing Tian: No, no other comments, really patient with the discussion, and also, you know, the stakeholder engagement.

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02:49:08.450 --> 02:49:10.119

Qing Tian: Thank you, Commissioner.

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02:49:10.540 --> 02:49:15.409

Commissioner Andrew McAllister: Fantastic, and just really, again, would encourage everyone to... who... who is so inclined to...

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02:49:15.600 --> 02:49:26.629

Commissioner Andrew McAllister: Marty, for example, you know, please file some comments. Sounds like an interesting technology. And if not immediately for the forecasting team, and maybe for the R&D team.

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02:49:26.750 --> 02:49:33.400

Commissioner Andrew McAllister: But, always looking for, new and interesting and effective, cost-effective technologies.

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02:49:33.640 --> 02:49:47.499

Commissioner Andrew McAllister: So, okay, well, with that, I think, great job, everyone. Really appreciate all the attention and, all the hard work on what we heard today. And back to you, Sandra, to wrap us up, or I can just adjourn.

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02:49:47.500 --> 02:49:48.689

Sandra Nakagawa: We are adjourned. Thank you.

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02:49:48.690 --> 02:49:50.869

Commissioner Andrew McAllister: Alright, we're adjourned. Thanks, everybody.