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IEPR COMMISSIONER WORKSHOP ON THE

UPDATED IMPACT STUDY OF THE BENEFITS OF DAY-AHEAD MARKETS

REMOTE VIA ZOOM

THURSDAY, JUNE 5, 2025

2:00 P.M.

Reported by:

Martha Nelson

APPEARANCES

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PRESENTER

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PUBLIC COMMENT

Dave Shukla

INDEX

P R O C E E D I N G S

2:00 p.m.

THURSDAY, JUNE 5, 2025

MS. NAKAGAWA: Alrighty, thank you for joining today's Integrated Energy Policy Report, or IEPR, Commissioner Workshop on the Updated Impact Study of the Benefits of Day-Ahead Markets. I'm Sandra Nakagawa, Director of the IEPR at the CEC. This workshop is being held as part of CEC's proceeding on the 2024 IEPR update. We are holding it virtually via Zoom.

As you probably got to notice, this workshop is being recorded and the recording will be linked to on the CEC website shortly after the workshop. To follow along, you can find the schedule, slide deck, and related materials on the CEC's IEPR website. Those have been docketed and posted.

We'll have a few minutes after the presentation today to take audience questions, but please be advised that we may not have time to answer all questions submitted. Zoom's Q&A feature is available for you to submit questions. You can also see questions that have been submitted and upload them by clicking on the thumbs up icon. Questions that received the most uploads are moved to the top of the queue.

Attendees will also have a chance to make public

comment at the end of the day. Please note that we will not be able to respond to public comments today. Those are also limited to a maximum of three minutes per person, with one person allowed to comment per organization.

Lastly, written comments are also welcome and instructions on how to provide those can be found in the workshop notice. Written comments are due by 5:00 p.m. on June 19.

Now I'm going to turn it over to Vice Chair Gunda for opening remarks from the dais.

VICE CHAIR GUNDA: Thank you, Sandra, for kicking us off.

I wanted to just welcome everybody today. Thank you so much for taking the time to join us. Thanks to everybody for helping develop the overall workshop for today. And then just, you know, a special thanks to Kai from the Brattle Group who will be going over the presentation of the updated results that we have.

Just as a reminder, part of last year's workshop -- last year's IEPR the CEC, in collaboration with PUC, worked on developing a contract with Brattle to, you know, have some independent analysis on the benefits and impacts of a larger regional market. We had that previewed, preliminary results were previewed in a previous workshop. And this is an opportunity for us to get updated

analysis from Brattle, taking into account some of the input from the workshop, both from the principals who were in attendance, but also the comments that we received from various attendees and stakeholders. So just wanted to give a big thanks to the Brattle group.

Also want to thank all the staff who have been working from both agencies on this issue, specifically at CEC. I just want to thank Jake McDermott, who has been leading much of this work, along with Commissioner McAllister's Office and our office, and just a big sense of gratitude to all the staff in the Energy Assessments Division.

With that, you know, I would really want to just jump into the conversation today, but I want to kind of invite my fellow Commissioners to provide any comments that they might have, starting with Commissioner McAllister.

COMMISSIONER MCALLISTER: Thanks, Vice Chair Guinda. I don't have anything to add really, just really appreciate the persistence. I mean, this has been a lot of back and forth, and I think, you know, it's in California's best interest really to understand how things might go and what sort of issues we might see emerge and what the real costs of those are.

So I just really appreciate the Brattle iteration to dig into some of those key issues and really try to put

numbers to as much of this as we can.

And thanks to Vice Chair Guinda, your leadership on this, and really happy to have President Reynolds and our colleagues at PUC here. I think we have Commissioners Douglas and Reynolds and Houck as well. So I really appreciate the collaboration with the PUC, really important stuff.

So with no further ado, I'll pass the mic back, I guess, to President Reynolds.

PRESIDENT REYNOLDS: Great. Thank you. I'll just start by saying it's always a pleasure to share the virtual dais with my colleagues at the CEC, so I'm looking forward to that.

And then also wanted to express my gratitude to everyone who has tuned into the workshop today. Really looking forward to hearing questions from participants. And then, of course, looking forward to hearing from Brattle on the results of their study. And we'll certainly be looking at this from the perspective of, of course, California, but, you know, in particular, the ratepayers who, you know, bear the costs of what we're all talking about here.

And so really excited to dig in on some of the analytical work that's been, that has been done. And I think this is really about thinking about the future and

evaluating paths for the future.

So I also want to thank the Energy Division -- Energy Commission staff. Always great work in gathering us together and hosting these workshops. And I really appreciate all of the work that everybody has put in to make this happen.

So I will turn it to the next PUC Commissioner who wants to jump in.

VICE CHAIR GUNDA: I would say, Commissioner Reynolds, maybe, you know, just we'll pass it to Reynolds, so we'll go to you.

COMMISSIONER REYNOLDS: Well, that sounds great. You know, I will just very briefly echo the thanks to the Energy Commission for inviting us to join and for all the work in prepping this workshop. I'm really looking forward to learning more and we'll pass it along to our next speaker.

VICE CHAIR GUNDA: Yeah, thank you, Commissioner Reynolds. And maybe we'll go to Commissioner Houck, and then Commissioner Douglas. Thank you.

COMMISSIONER HOUCK: Hi. Good afternoon. Thank you to the CEC, all of your staff, our staff, everyone that's been working on this really important issue. I'm looking forward to hearing the presentations and additional information.

I do have to leave partway through. I'm not sure if the -- I think it's being recorded, so I'll be able to catch the second half later, but I have another hearing that starts at three o'clock. So I'll be here until then.

Thank you, and I'll turn it back over to you, Vice Chair.

VICE CHAIR GUNDA: Yeah. Thanks, Commissioner Houck.

Commissioner Douglas?

COMMISSIONER DOUGLAS: Not much more for me. I just look forward to the presentation and discussion.

VICE CHAIR GUNDA: Thank you, Commissioner.

So one of the friendly competitions we have is how many Commissioners show up on each side. So we'll officially note that CPUC Commission takes today's win.

So with that, just recognizing for the attendees, the number of principals on the call just suggests how important it is to all of us. Again, with a big sense of gratitude to all the staff and Brattle for their collaboration. And also want to just note, CAISO, who has been an integral partner in all the work we do.

So with that, I will, you know, welcome Kai. Thank you. You're up. Thank you.

MR. VAN HORN: All right. Thank you, Commissioners. And I would just echo the sentence, I

appreciate the opportunity to be here to present our updated results of the market benefit studies that we've been doing with the CEC staff.

And also, I'm grateful for the folks who have taken the time to tune in and for all the questions we get when we go through these workshops and use that feedback to improve the analysis we do. And hopefully, it will make it more useful for California ratepayers and California legislators and you all as you make these difficult decisions on the future of California's energy system.

I will share slides and we can get started here.

All right, so I'm here on behalf of my team. And I should also acknowledge the enormous amount of effort that they put in in order to make this possible today. But I'm going to talk today about the updated benefits results that we have been working on since the workshop in January, responding to some feedback we received there and questions at the January workshop.

However, before I get into the new analysis, I just want to take a few minutes to level set on the study, why we're doing it, and then give everybody a brief review of the benefits that we found at the January workshop so that we can all sort of start off on the same foot when we jump into the sensitivity results.

So as most here know, EDAM is scheduled to launch

with several California utilities and utilities in neighboring states. But at the same time, there's another market, a day-ahead electricity market forming in the West, Markets+, and many other Western utilities are exploring participating in that market, which will not include California.

So generally speaking, day-ahead markets are advantageous because they can deliver cost savings to customers through efficiency gains. They can deliver environmental benefits through lower emissions, generally through better utilization of renewables, and can deliver reliability benefits by making it easier to manage the grid during periods of extreme conditions through centralized coordination of the resource mix across a wider area.

In our study, we calculate the benefits to California of additional utilities in the West participating in the anticipated EDAM market. And we studied the 2032 year as a proxy for the first decade of market operations. And our model is based on a couple of primary sources. One is the resource assumptions from utility IRPs and the CAISO TPP, and also the extensive review of inputs and modeling efforts that we've done for more than a dozen utilities over the last two years on this very question of the impact of day-ahead markets for those utilities and the benefits they might see from

participating in those markets and the different configurations of those markets.

The key thing is that the benefits of an EDAM market for California will depend on the size and diversity of the members that join. A larger and more diverse footprint should deliver more benefits for California.

So that's the study that we've undertook, that we've undertaken. But in order to get at this answer to the question of how California -- what are California's benefits of an expanding EDAM, and how might they scale with the markets that could emerge in the future, we initially analyzed four market participation scenarios. And that was the basis of the results that were presented in January at the IEPR workshop.

The first two cases are our Baseline and Baseline+ case, which represent potential near-term outcomes for the EDAM, the first, the Baseline case, being the entities that have committed to participating in the EDAM in the 2026, 2027 timeframe. Though even since we conducted that initial study, there have been, TIDC has also committed to 2027, I believe, so this has even grown since then.

Our Baseline+ case then represented a near term in which some of the entities, notably Idaho, Nevada, and PNM have joined. Those are entities that have expressed

interest in joining EDAM. And so in that case, everybody who's expressed EDAM, in addition to the committed entities, is the footprint of the market. With everybody else in the West, either remaining in the WEIM, the real-time market that covers most of the West today, or remaining only in bilateral markets, the gray bubbles here.

Our other two cases represented potential longer-term market footprint outcomes and kind of captured the bookends of where the West might go in terms of a day-ahead market. The first of them, the Expanded EDAM case, in this case, we assume that the EDAM expanded to include everybody, every entity who's not already in -- not going to be in SPP's RTO West, the yellow bubbles over here. So it's a sort of one market for the West EDAM.

Our fourth case, the Split Markets case, is if there's two markets in the West, which is to say the Markets+, which is also in the process of being formed, basically comprises everyone who is not in our Baseline+ case in EDAM.

So we looked at the benefits to California in each of these four cases, or we simulated each of these four cases for 2032 and looked at the benefits to California of EDAM relative to the Baseline case and the Baseline+ case. So I won't go through all of the details there now. Those are available in the appendix of this

slide deck, which is posted as well as in the posted presentation from January. But at a high level, we found that California customers benefit to the tune of around $800 million per year in net benefits in our biggest EDAM footprint, Expanded EDAM relative to the Baseline case.

We also found that those benefits are about $500 million higher. That one market outcome is about $500 million of benefits higher than a two market outcome in our Split Market case. It's also about $650 million higher than in the Baseline+ case. So we can see that the growth of the market has substantial value for California customers as simulated in our study.

In terms of emissions and renewable curtailment impacts, the improved investment environment for renewables in our expanding footprint could accelerate the trend towards lower emissions in the WECC. We find that in our study that the emissions WECC-wide, CO2 emissions are about 30 percent lower in 2032 than in 2024. And we also find that the Expanded EDAM, the largest footprint results in about 10 percent fewer solar and wind curtailments in California relative to the other market footprints. So it's an appreciable savings or a better utilization of renewable resources that are online at that time.

From a reliability perspective, we find that the -- we found that the Expanded EDAM case, you know, gave

California access to more surplus capacity within a broad market footprint compared to a two-market case in the Split Market case. And that's additional capacity that could be used to serve California customers during emergency events.

Additionally, a larger footprint, you know, can allow California to benefit from and draw on greater load diversity across the region and renewables diversity, which can be beneficial from a reliability perspective for California customers.

So after we had conducted those initial cases and presented them at the workshop, you know, we got a lot of feedback. And in order to delve deeper into our findings and to address questions raised at the workshop, we wanted to conduct -- or we worked with the CEC staff to design three sensitivity analyses in order to provide more detail on our findings.

The first of those is the Status Quo case. And I'm going to go through each of these in turn today as part of this presentation. So the first of these is a Status Quo case, which allows us to basically fill out the picture of market benefits for California by focusing -- as we did in our initial study, we focused on the benefits of expanding the EDAM. So all of our cases had an EDAM footprint in it already, but there are benefits to California customers of EDAM forming. And so we wanted to

add in the Status Quo case to provide a complete picture of the benefits of an EDAM market and also to provide more insight into the emissions impact of a market relative to that new Status Quo case, a case that looks more like the markets of today rather than the markets that are coming.

And we also wanted to -- we also ran a lower natural gas price cases. We wanted to test the robustness of our benefits to this important assumption, natural gas prices drive prices and drive benefits. And so we wanted to test how our benefits results change under a lower gas price scenario, and also understand the impact of natural gas prices on emissions outcomes because of the relationship between natural gas dispatch, natural gas prices, and the dispatch of coal-fired units.

And third, we conducted a market revenue analysis for California Solar to analyze the changes in California's solar market revenues across these cases and how they shift with EDAM expansion and what the ramification -- and to qualitatively think through the ramification for renewables developments and the longer term capacity mix in California and the rest of the WECC.

All right, so the first sensitivity analysis was our Status Quo case. So I'm showing here the four cases that we ran in our initial study on the right. And then on the left here with the pink dash box around it is our

Status Quo case. So as I mentioned, our initial cases are near-term or longer-term outcomes for the markets and allowed us to measure the benefits of EDAM expansion in the Baseline+, Expanded EDAM case and the impact in the Split Markets case relative to our Baseline case which is the initial EDAM committed entities.

Our Status Quo case kind of goes back one step in terms of market developments and says, okay, this is the markets as they are today where we have -- as we have them today, you know, plus a few changes that we know are coming. So we have the CAISO, which is the day-ahead market, you know, of course in California. And then we have the WEIM which covers most of the West. And then we have the RTO West footprint which is in the Rocky Mountain area. And so we included this case and we simulated this case and this allowed us to now have a Baseline of no market in order to compare the cases we had already simulated.

So our initial study focused, of course, on expansion. But what we find when we have the Status Quo case is that our EDAM formation accounts for an additional roughly $200 to $300 million per year in market benefits for California. So that's incremental to the benefits we had measured in our initial cases. So here, again, I show the footprints for the three EDAM cases just to focus on

the expansion impact. And we show total system cost in each of those cases as simulated, so this is adjusted production costs, and then trading related benefits netted for trading-related benefits.

And we can see here that in the relative to the Status Quo case in our Baseline case, California sees benefits of about $290 million per year and $400 million per year in the Baseline+ case and over a billion dollars, almost $1.1 billion per year in the Expanded EDAM case. And this is compared to that around $800 million per year relative to the Baseline case. These numbers shown below are the ones I mentioned or is the one I mentioned earlier when I was giving the overview of the workshop in January.

For Split Markets, I haven't shown it here, but the benefits from that case also move in a similar way, about $300 million per year against this new Baseline. But the details of those are in the appendix for anybody who's interested when looking at the slides.

The impact on economic benefits -- but we also want to look at the impact on generation in the state. So what we find in these cases with going from no market to having an EDAM market is that there's a substantial impact on curtailment in California. We see roughly a 68 percent reduction in wind and solar curtailments. That's unlocked by the greater coordination that can be enabled with the

day-ahead market. We find that that curtail, those previously curtailed renewables, account for more than 10 terawatt hours of generation. And that additional wind and solar generation displaces gas generation in California.

This chart in the center is showing the difference between our Baseline case and our Status Quo case in terms of generation. So this is showing on the curtailment over here, but this is total generation in the Baseline case by each type of generation, and then we subtract from that the total generation in Status Quo case for each type of generation. And so we see roughly a 16 terawatt hour increase in renewables and roughly an 8 terawatt hour reduction in gas generation in California.

And so, this, as we'll see in the next slide, has ramifications for California emissions. But also because the amount of additional renewables exceeds the reduction in in-state gas generation, it's also increasing exports of renewable generation to the rest of the West, which is beneficial from an emissions perspective in other parts of the WECC.

A couple of other benefits of these lower curtailments. One is that when there are fewer curtailments, that can typically allow fewer resources to be built in order to meet state renewable energy targets. You know, those targets often require a certain number of

megawatt hours and curtailed energy requires more capacity to get the same number of megawatt hours from renewable generation.

We find that reduced -- or we also -- reduced curtailments also result in fewer periods of negative pricing and can increase market revenues for renewables. So I'll discuss this later as well, so I won't dwell on it here, but that tends to accelerate the development of renewable resources.

All right, now, to the emissions impacts of these changes and the emissions impact relative to the Status Quo. We find that in the model footprints that we have compared to the Status Quo, emissions decline. However, really, the majority of emissions changes in our cases relative to today are driven by changes in the resource mix.

So these two charts I show here, the first being WECC-wide emissions in 2024 historical relative to our Status Quo, Expanded EDAM and Split Market case in 2032. So these are million metric tons of CO2 emissions. I'm showing the changes in absolute terms in the table to the right of the chart, but what we see is about -- there's about a 37 percent decline in historical emissions relative to historical emissions in our Status Quo case. And then an additional three percent decline compared to that into

our Expanded EDAM and Split Markets case.

So this is what I mean when I say that resource mix changes between 2024 and 2032 are a much bigger driver of emissions reductions than the market. So the market does -- the formation of the market and expansion of the market does -- or the formation of the market does reduce emissions as well in this case.

In California, there's a bit of a bigger impact because there's such a big reduction in gas generation within the state. So in our Status Quo case, we see about a 34 percent reduction in emissions from 2024. And then moving from the Status Quo case to the Expanded EDAM case where we see that huge reduction in curtailments, which displaces significant gas generation within California, we see that that results in another 35 to 40 percent reduction in emissions within California in the Expanded EDAM case.

So that concludes the detail that I'll go through on the Status Quo case. There's additional detail in the appendix. And, of course, we'll have time to talk about -- or I'll have time to respond to any questions at the end.

And now I'll move into the low natural gas sensitivity cases.

So looking at natural gas prices in our initial scenarios, our gas price outlooks in that case put gas plants above coal plants in the supply stack in most cases.

So this diagram I'm showing here on the right is an illustration of the average supply curve that we simulate in 2032 in our initial cases. So the y-axis, I apologize, it's a little difficult to see, but it's operating costs in dollars per megawatt hour going from $0 up to $100 per megawatt hour. And the x-axis is cumulative capacity in the WECC. And the different colors are different types of capacity.

And so as we move from left to right, you know, we can see how the costs of resource -- and the resources are stacked in order of increasing cost. And so we can see in our initial cases with the gas price assumptions we had there, these vertical lines are -- this dashed vertical line is average load, and this blue solid line here is the minimum load. We can see that for the most part, gas plants are more expensive than coal plants in the supply stack at the gas prices we had assumed in our initial cases, except in some few very low load hours where coal is -- some coal plants are more expensive than some gas plants.

And because gas -- so there's two -- so gas prices, additionally, are, you know, of course, a strong driver of market prices, and thus an influencer of market benefits. So our hypothesis here was that lower gas prices, of course, will create more competition. Because

of this dynamic in the supply curve, lower gas prices would create more competition between gas plants and coal plants, and especially in an expanded market with fewer barriers to trade. So there's more direct competition between resources of different types without transmission charges between areas.

So we constructed these cases to understand the impact of the lower fuel prices on simulated market benefits and the relative benefits between our different footprints, but also to understand the impact of lower gas prices on emissions outcome due to this increased competition with lower gas prices between coal and gas.

And what we find in terms of benefits overall is that the benefits for California remain significant even with lower gas prices. So our benefits across the five cases -- so we re-simulated all of these cases with lower natural gas prices, about 25 percent lower. We find that the be-fits across all of the cases relative to Status Quo remain about $244 to $900 million in the EDAM cases and about $600 million per year in the Split Market case.

So here again, I'm showing the total system cost in our low natural gas price cases and the cost differences relative to Status Quo, Baseline and Baseline+ below the blue bar. So we can see here that the, yeah, the benefits for California customers remain at -- they remain above the

levels relative to Baseline+ and near what we had seen in our original cases in order of magnitude.

What we find though, also, is that, you know, lower natural gas prices lower the overall cost of operating the system. And so in order to sort of make a more apples to apples comparison, we looked at the percent change in benefits in the initial cases relative to the percent change in these cases to put it on a similar basis. And then what we find there is that California benefits range from about 6 percent to 20 percent of Status Quo costs in our low natural gas price cases versus 6 percent to 22 percent in our initial cases. And so as a percentage of total system costs, benefits are actually quite similar whether we use our original natural gas prices or whether we have lower natural gas prices.

So our takeaway from that is that, you know, the benefits results we see for California here and the takeaway that, you know, having a bigger single market is more beneficial for California and that there are -- those benefits that we see are robust to this difference in gas prices. If we were to see lower gas prices in the future, those benefits would remain.

Just to focus a little bit more in here, I'm showing here, actually, the initial total system costs and lower natural gas price system costs in -- below the maps

here in the blue row. The initial costs across the board, you can see are lower than the initial cost. That's the impact of having lower natural gas prices and lower production costs.

And then I'm showing the change to Status Quo. So the relative to Status Quo, how did the benefits in each market footprint scenario change? So we see a slight reduction in benefits in Baseline relative to Status Quo, relatively similar in Baseline+, a reduction in benefits in the Expanded EDAM case, and then a relatively similar benefit in the Split Markets case.

But generally speaking, the benefits drivers with lower natural gas prices remain the same. You know, there's some cases we see higher like production cost savings with the lower natural gas prices and others, the ones that the cases like Split Markets where production costs were higher to begin with. But the relative benefits and for production costs and from trading related impacts, they don't shift much across with the lower natural gas prices. They just are lower overall.

And then the other question we had was how are emissions impacted by the lower natural gas prices? And so what we find is that emission shifts across cases are relatively similar with the lower natural gas prices, but that emissions are reduced overall with natural gas prices.

So another way to think about that is that we do see the effect that we hypothesized with the supply curve where gas is moving down below coal in the supply stack, and so it's displacing, some coal generation is being displaced, which results in a reduction in emissions overall, but that between cases, the existence of the market is not resulting in significantly more competition between coal and gas such that the dynamic is changed.

However, we still see a substantial reduction in emissions relative to 2024, as I talked about before. And in this case, because overall emissions are lower in the lower natural gas price cases, you know, the percent reduction in emissions is higher. Similar, the same -- it's the same trend for our WECC-wide cases. And then also in our -- in when we look at California, around a 35 percent reduction in emissions relative to historical. And then another 35 percent reduction in emissions relative to our Status Quo case.

All right, the last piece I wanted to touch on is a market revenue analysis for California solar that we conducted. So in this -- so generally speaking, a broader market footprint enhances the value of renewables, you know, through greater load and resource diversity. You know, it can reduce aggregate forecast imbalances within a broader footprint. And there are more opportunities to

sell excess renewable output. You know, the production and curtailment that we saw from our Status Quo case is an example of that. So we conducted an analysis where we looked at each of the cases for CAISO and all of California at the average revenue earned by solar plants over the year that we simulated, calculating revenues on an hourly basis and then, you know, summing all those revenues up and then dividing by the total amount of energy generated by those plants to calculate the average amount they turned over the course of the year.

This table on the right summarizes the results of that analysis. The first two rows here show the capacity of solar that we simulated for CAISO and all of California. And then the average revenue in the Status Quo, Baseline and expanded EDAM cases. Again, I didn't show the Split Market case here, but the results there are almost identical to the Baseline+ case.

And then the light blue highlighted rows here show the difference in revenues relative to the Status Quo case in this first set of rows and then relative to the Baseline+ case in this last set of rows. So the way to think about that is that this first set of rows here shows the revenue impact of market formation in this case, and then the revenue impact of market expansion in this case. And, you know, similar to the sort of result I showed

earlier about curtailments, how curtailments increase significantly -- or reduce -- they decrease significantly moving from Status Quo into the Baseline case, and then reduce again modestly going to the expanded EDAM case, that's sort of the dynamic we see playing out here as well.

In our Status Quo case, we see that over the course of the year, of course, this is an annual average, so it's not in every period, we see, though, that average solar revenues actually fall slightly below zero due to the scale of curtailment and the negative -- and the instances of negative priced hours.

With the formation of the EDAM into the Baseline+ case, we see that move to about $12.00 per megawatt hour -- or move up about $12.00 per megawatt hour to around $8.00 per megawatt hour. And then with the further expansion of the EDAM and the expanded EDAM case, we see that move up to about $10.00 a megawatt hour, so it increases by a further $3.00 per megawatt hour.

So California, being a key resource for meeting clean energy targets in the state, it shows there's significant benefits from market formation and expansion for solar and for other renewables. We see that these improved market conditions are mostly driven by the higher midday prices in California relative to our Status Quo case.

So the ability to sell out that solar results, the solar excesses typically occur during the middle of the day, and that's when we see instances of negative pricing. In the expanded EDAM case and the Baseline+ case, there's many fewer hours in which that's the case, and so those revenues during the middle of the day go up. These increased market revenues, though, for California solar resources, a lot of this would flow through to customers in the form of lower PPA costs in the longer term.

We also believe that higher market revenues tend to reinforce trends toward -- the trend in the WECC towards more solar and more wind by improving the longer-term investment environment for these resources. So the anticipation of higher market revenues, you know, reinforces the already present trend of replacing thermal plants with renewables or as thermal plants go offline.

So that concludes my description of the latest results that we have. There's a lot more, of course, detail, but that's available to view in the appendices of this presentation. But at this time, I'm happy to answer any questions that folks have about the results.

MS. NAKAGAWA: All right, let's go to Vice Chair Gunda and the dais first to see if they have any questions.

Vice Chair, or if there's any other Commissioners or dais members who have questions for Kai?

Commissioner McAllister, I see you have a hand up. Go ahead.

COMMISSIONER MCALLISTER: Yeah. Great. Thanks, Kai, that was great. And, yeah, I really appreciate your kind of iterating on this analysis and making sure that all the pieces kind of are additive and internally consistent.

I guess last time we had a conversation about sort of the potential inefficiencies around the seams between, you know, the scenarios that -- you know, particularly the sort of dual-market scenario where, you know, there would be a need to navigate across seams, and sort of I think we were all a bit fuzzy at that time about what that would look like in practice and what kind of costs that would drive. And I'm wondering how you've sort of taken that conversation and incorporated it into the relative costs of the dual market scenario and say the Expanded EDAM scenario sort of general --

MR. VAN HORN: Yeah, so --

COMMISSIONER MCALLISTER: -- just generally?

MR. VAN HORN: Oh, yes. Well, thank you. Thank you for that question. I think that's a really important topic to raise, you know, when we're talking about day-ahead markets now, especially given announcements in recent months of entities going into Markets+ and the likelihood of having two day-ahead markets, which is greater now than

it was in January.

But, so in the presentation that I just gave and the results we've done so far, we haven't changed our approach to representing the market seams. However, this is a very complex topic and we've been working on a couple of -- we've been talking about a couple of other analyses we might do to specifically target the impact of seams, both in the day-ahead market, but also in the impact of WEIM separating in the Split Market case and the potential ramifications of that loss of -- or the creation of that seam where it doesn't exist today.

So I'm sorry to report that I can't -- that there's nothing new on that right now, but that is something that we are working on.

COMMISSIONER MCALLISTER: Yeah, I appreciate that. Just I think it's an interest, just pragmatically, as we all think about what these various scenarios would look like in practice. And we're going to have to navigate that at some point, likely. Appreciate that.

MS. NAKAGAWA: Any other dais members with questions for Kai?

VICE CHAIR GUNDA: I don't. I apologies. I just, you know, Kai, I just wanted to say thank you. It's very clear. I mean, you know, I benefited from a few briefings on this.

I think one piece that would be helpful if we go down, go back to I think the conversation around the overall curtailments and then how you see the production cost modeling helping, that's one.

And then two, just on the supply stack that you have, as you think through the supply stack and the dispatch, you know, just trying to understand how are we thinking about in state, you know, kind of gas units or coal units and how does that play out? If you can expand on that a little bit more for the record, that will be helpful.

Those are my two questions. Thank you.

MR. VAN HORN: Yes. Yeah, so I think for the supply stack, you know, the supply stack, and I'll go to that first, maybe. Yeah, the supply stack here, that I'm showing here, one thing I would say is that this is a gross simplification of how we model the system. We do capture, you know, all of the transmission limitations between various regions and model the supply curves within each region, you know, directly. So what I show here captures all of the WECC and gives us like a broad sense of how things will shift. But there's a lot of detail within the case.

But I think, you know, with the -- if I've understood the question correctly, and please jump in if

I'm going off in a direction that you weren't asking about, Vice Chair, but the reduction in curtailment would tend to push the supply stack to the right. And so to the extent that that is during periods in the spring of also low load hours, of lots of hydro, lots of wind, lots of solar, and that that could create more competition between coal and gas resources because that's the -- those are the periods of time when we see more competition between those resources, just broadly speaking. Yeah.

And in terms of in-state versus out of state, the curtailment reductions I showed there were all in-state California curtailment reductions, and we do see, you know, impacts on curtailments elsewhere. But we see a lot of -- the majority of the impact within California.

VICE CHAIR GUNDA: Thank you so much, Kai. I know there's a lot of questions coming in and I want to be at least able to provide opportunity.

So let me ask, first of all, on the panelist side, Commissioner, do you have another question?

COMMISSIONER MCALLISTER: Yeah, I have another question, actually, thanks for that.

On the, let's see, I think you said that, you know, lower curtailment actually creates opportunities to push renewables out into the broader Western grid as well, which lowers emissions broadly, which makes sense. But

also there was, I forget which slide number it was, but where you have the reduction in emissions from Baseline -- yeah, there you go -- it looks like the West-wide emissions don't really change much between, you know, in the right the rightmost three scenarios a little bit. But then you say that -- then on the right, you've got the California scenario where they do actually drop a lot, you know, from the Status Quo to the expanded scenarios.

So that would seem to imply that emissions would have to go up across the West to stay the same, the rest of the West to stay the same. So what's going on there?

MR. VAN HORN: Yeah, yeah, no, that's a great question. And the reason for that is twofold. One is that, you know, the total emissions in the WECC as a whole outside are just much larger than the emissions in California. So the injection of additional, you know, 6 terawatt hours has less of an impact on a percentage basis on emissions than it does in California where that, you know, that amount of additional renewable generation has a much bigger impact on a percentage.

COMMISSIONER MCALLISTER: Okay. I'm noticing the difference in scale in these two graphs. So, yeah, okay, that makes sense --

MR. VAN HORN: Yeah.

COMMISSIONER MCALLISTER: -- 200 on one and 40 on

the other. Okay. Yeah. Gotcha. Great, that helps. Thanks a lot.

MR. VAN HORN: Mm-hmm.

VICE CHAIR GUNDA: Thank you, Commissioner McAllister.

I don't know if any other principals have questions? If not, I would want to check with Sandra.

Sandra, would we want to go to a Q&A and help answer as many questions as we can and have the discussion?

MS. NAKAGAWA: Yeah, I'm going to pass it over to Jake McDermott from the CEC to moderate our Zoom Q&A. Again, if folks do want to ask the question of Kai, you can submit that with the Q&A feature, the raised hand. We will save that for public comment at the end.

So over to Jake.

MR. MCDERMOTT: Thanks, Sandra. Good afternoon, everyone. Thanks, Kai, again, for your presentation.

The first question actually is, it follows on pretty well with the Vice Chair's question. If we could actually go to slide eight.

So there's a question that we have about, "How did Brattle model wind and solar generation, displacing gas generation, including peaking and base load in California, please?"

MR. VAN HORN: Yeah, so the way we model is to,

you know, model every hour and we model all of the WECC and all of the generators and the transmission network. And so each resource within California, wind or solar, has an hourly shape of generation. And that's different in our day -- we have a day-ahead market cycle in our model in real time, and the amount of generation available includes the uncertainty between day ahead in real time.

And then gas plants are modeled through an economic dispatch and unit commitment mechanism, much like the way that the CAISO market operates. So the model is finding the least cost way of meeting demand with all of the resources available.

And so if we see a reduction in curtailment, that means more renewables can be brought onto the system for a variety of reasons. And if those renewables are available in an hour, but they weren't available before, then they would tend to displace gas because gas, it has a cost associated with its production. And so that the model would tend to reduce the gas resource outputs in order to favor lower cost renewable generation when it's available.

MR. MCDERMOTT: Great. Thanks, Kai. I think this might be implicit in the answer, but just to kind of just to check is the comparisons that we're making here, right, those are in this first chart in the middle, it's really this comparison, right, between the Baseline outputs

and the Status Quo outputs; right? So you can kind of see how the model responds in the different cases and which one is picking over different units.

MR. VAN HORN: Yeah. Thanks, Jake. Yeah, thanks for that. Yeah, that's exactly right. Yeah.

We basically have run these five footprint scenarios that have simulated the entire year of 2032 and the entire WECC.

And then we can look at how much gas generation was there from all the gas plants in California, how much renewable generation was there from all the renewable plants in California in all the hours, and then, yeah, make comparisons to see, you know, did expanding the market -- what was the impact of expanding the market on, you know, on generation in each of those categories?

And what we find is that, yeah, renewable generation displaces gas generation.

MR. MCDERMOTT: Perfect. Thank you.

We have a question here about coal. So the question is that, "Coal units have lower -- having lower marginal costs than natural gas will favor the use of coal first, which means more coal use and more deadly emissions. How do we reduce the use of coal with the Trump administration's support of, quote, 'the beautiful, clean coal,' unquote?"

MR. VAN HORN: Yeah, I don't know if I can comment on the broader question of how to reduce coal relative to the Trump administration's policies.

But, you know, one way that, you know, California has, you know, has attempted to reduce the impact of, you know, dispatch of coal generation for meeting California load, and this is something that we capture in our simulations, is imposing carbon charges on imports of electricity into California, you know, based on the type of resource that -- from which that energy comes from.

And so that imposes a significantly higher cost on coal generations, coal generation to serve California demand than it does for gas and, of course, significantly higher than a wind and solar resource that may not have to pay any carbon charges at all.

So I think, you know, it's within expand in the expanded market. Of course, the market is finding the least cost way to dispatch. But because the market as conceived, the EDAM market as conceived will continue to impose those carbon charges on resources that whose output is transferred to California, coal will, still, will continue to be very expensive when it comes to serving California load.

MR. MCDERMOTT: Got it. Thank you. And I believe this is true, right, that the Brattle's analysis

shows that the cost of compliance is so high for coal units that no coal is ever imported into California?

MR. VAN HORN: Yeah, that's correct, Jake. Yeah, there's no coal imports into California. In a cost minimizing environment in an expanded market, the market is going to try to -- is going to find lower cost options. And in this, in the case of the WECC where there's abundant wind and solar and hydro outside of California, there's plenty of that, we find in our studies, plenty of that to serve California's import needs and no coal gets imported.

MR. MCDERMOTT: Got it. Thank you.

I'll take one question here that comes from Kanya at Cal Advocates. Kanya asks, "Should Brattle consider the Split Market case with BPA joining SPP Markets+ since that happened this May? Is the scenario of BPA joining SPP Markets+ the scenario with the highest cost for California and the lowest benefits?"

I'll just answer that. I answered a similar question in the chat as well. But some of this work with Brattle began in earnest after the initial January workshop. So we haven't had time live to respond to all of the different changes that are happening with the market participation footprints. But the Energy Commission is continuing to look at different sensitivity analyses, including different kinds of market participation

scenarios. So this could be something that we look at for the future.

And I'll do another one for Kai here. So a clarification is, "You modeled market price savings, not net ratepayer impacts, which would include any new transmission capacity costs and other factors; is that right?

"And number two, the market prices you modeled are the bid prices, not the clearing price actually paid, which means actual realized cost savings will be less; is that correct?"

MR. VAN HORN: So in the first instance, yes, we didn't calculate, you know, the total impact to customer rates. We didn't go through like a sort of a rate calculation. But we did calculate, you know, the wholesale market impacts generally, which we think are indicative of the benefits that customers would receive once those flow through to rates.

In the second instance, we actually -- what I was showing actually was based on cleared market prices rather than resource bids. And so, yeah, all of the analysis we've done, you know, is based on, you know, the market prices and costs coming out of our simulations. And so generally speaking, when we do market revenue analysis, that is based on the cleared market prices that are an

output of the simulations that we do and that sort of mimic the markets, the day-ahead in real-time markets that exist today in the way that they're formed.

MR. MCDERMOTT: Awesome. Thank you, Kai.

So another one from Kanya here. This is kind of going back to the curtailment issue, as well as BPA. "Did BPA play a significant role in reducing California solar curtailment?"

So I guess kind of the implicit question there is when we see reduced curtailments in the model, you know, where are those -- where is that solar and wind headed?

MR. VAN HORN: Yeah. Well, you know, the biggest reduction in curtailment actually comes between our Status Quo and our Baseline case. And so that's a case, the Baseline case is a case in which BPA is not in the EDAM market. And so the formation of the EDAM market alone and the coordination that can happen between CAISO and neighboring balancing areas is a big driver of curtailment reduction.

In the Expanded EDAM case, the case in which BPA is in a market in the EDAM market with California, we see a further reduction. And so I couldn't say exactly how much of that is due to BPA, but, you know, having flexible hydro, they would -- I would expect that they would make up a meaningful proportion of that additional 10 percent

curtailment reduction. But the majority of the reduction is from the formation of EDAM and that comes even without BPA in the market.

MR. MCDERMOTT: And maybe something we can take back internally, too, is if, I wonder if we can look at this more deeply, too, and kind of where curtailments are heading and how to try to measure that impact of which balancing areas see different flows.

We have a question here from Dave on, "Where is the no coal to California because of compliance costs slide? Pretty important info."

I wonder, Kai, if we have -- if you have anything on the deck around what the total other imports or anything about that issue in the deck?

MR. VAN HORN: I can't remember if we have -- we should have a summary. We have lots of summaries of trading, but I'm not sure if we've summarized the trading into California by resource type, the imports by resource type. So I don't think that specifically is in the deck, even though we have a lot of summaries of trading by trade type and these types of things. But that's something that, you know, of course, would be very -- we could put together and add.

MR. MCDERMOTT: Great. And I think there's one more question that we have here, which I'll take a shot at

answering. So it says that, "There's a fact sheet that says that the Expanded EDAM yields about $1 billion per year in economic benefits to California compared to the Status Quo scenario. But isn't this total, this number totally fictitious because" -- the commenter gives two reasons, so one is that, "it ignores the fact that the basic EDAM is going into effect in 2026 with or without SB 540, so the updated study is like comparing skiing down a rocky mountain with no snow with skiing with lots of good snow.

I think one of the underlying purposes and rationales of the study is to really analyze what is the benefit to California of different market participation scenarios under EDAM? That is to say, how does the size of EDAM itself contribute to accruing benefits to the state of California? And I think one of the reasons why the Status Quo number is so important is because it shows that Status Quo where there is no extended day-ahead market outside of California that we are participating in.

So I think that's the value in this, is to really show and drill down into the benefits that different market scenarios can provide relative to today.

The second reason here is that, "It also assumes that in 2032 there will be a total unified west-wide grid, otherwise known as Expanded EDAM, but this is never going

to happen, especially now with the Arizona utilities and BPA and others definitely going to Markets+. So what is the validity of any of the numbers using the Expanded EDAM case?"

I've touched on this before, but we started this work in earnest in January after the initial workshop. And so there have certainly been some developments in terms of which entities are going to which markets. Since then, we wanted to report all of the information that we were able to find along with this analysis. So that's kind of the intention of including the Expanded EDAM in this analysis as well.

I think I have another question here for you Kai. So the question is, "It seems like size is less important than geographic time zone, place, and resource type in terms of diversifying renewables options for California to contract with."

It's not really a question there, but I wonder if you have any thoughts or feedback on that in particular?

MR. VAN HORN: Yeah. I mean, I think that, you know, size is kind of like a necessary but not sufficient condition for a market to have high benefits.

The diversity point is a really important one. I'm glad the commenter made that point because as we said at the beginning EDAM will benefit California if it expands

and creates more diversity in the footprint. It's possible for the market to expand and provide very little additional benefit if there's not additional diversity. But what we see actually is that there is a lot of diversity in the West between -- and the commenter mentioned a few aspects of that diversity, whether it's time zone diversity or whether it's renewable resource output diversity, there's a lot of diversity in the West.

And so I think, given the sort of state of play in the West with this diversity that does exist, expanding the scope of the market almost means expanding the amount of diversity within the market.

MR. MCDERMOTT: Thank you. And I think that's all the questions that we have so far in the Q&A.

I might pass it back to the Vice Chair if he has any other questions at this time?

MS. NAKAGAWA: All right, if you don't have any further questions from the dais, then we will go on to our public comment period.

So one person per organization made comment. And we are limiting comments to three minutes per speaker. A reminder that while we welcome comments, we're not able to respond to them during this public comment period. The notice does, for this workshop, provide some information about how to contact us with any follow-up questions you

might have about today's workshop.

So we are going to use the raised-hand feature in Zoom for public comments. We will call on you and then open your line to make comments. For those who are dialing in via phone, you would hit star nine to raise your hand and then star six to mute or unmute your phone line. And we can also help from our end to unmute that line as well.

So let's do Zoom first. I'm going to call on folks with raised hands using that raised-hand feature on Zoom. If anyone would like to make a public comment, now is the time to use the raise hand feature on Zoom.

All right, I'm seeing first up Dave Shukla. Let's go over to you.

MR. SHUKLA: Hello. Can you hear me?

MS. NAKAGAWA: Yes, you're coming in loud and clear.

MR. SHUKLA: Thank you. Well, thanks for the presentation, and to the Energy Commission for organizing and hosting this.

I think I would appreciate, I think, a lot of people who are very concerned about energy affordability issues in California would appreciate having a ratepayer kind of end-consumer kind of analysis of benefits, changes, costs, whatever would be implied by seeing the different scenarios studied.

I understand some of the rhetoric behind continuing to keep hammering on the Expanded EDAM case but that's a best case scenario. It's much more likely that there will be some variety of Split Market scenarios. So I'd like to see, personally, some more tailored scenarios and analyses.

But also generally on the issue of data, I mean, you know, I appreciate that it was answered earlier but, you know, if it's possible to include a slide on how much the compliance costs for certain facilities that would be included in let's say the Expanded EDAM case or the Baseline case for California that either fall in or fall out of the resource mix, that would be really helpful.

And then also being someone who, you know, has long-time personal experience with one of those on the supply side, it would be really helpful to know what batteries do. I mean, I don't think that was one of the sensitivity analyses. But, you know, there's a lot of batteries coming online in California system and I think that's going to change the kind of shape of some of these curves also.

So, yeah, thank you.

MS. NAKAGAWA: Alrighty. Thank you, Dave.

If there's anyone else who would like to make public comment who's joining by Zoom please use the raised-

hand feature for now.

Alrighty, we will go to phone lines. If you are on the phone via Zoom, you can hit star nine to raise your hand, and then I'll call on the last three digits of your phone number if you would like to make a comment that way.

All right, not seeing any public comments from the phone lines, so we will then turn it back to Vice Chair Gunda for any closing remarks from the dais.

Thank you everyone.

VICE CHAIR GUNDA: Hey Sandra. I'm sorry, I'm kind of like, my mic is struggling here.

MS. NAKAGAWA: We can hear you on this side, yeah.

VICE CHAIR GUNDA: Can you can you hear me okay? Okay.

MS. NAKAGAWA: Yeah.

VICE CHAIR GUNDA: Sorry. So just wanted to make sure any other principals have any questions or comments before I go?

COMMISSIONER MCALLISTER: Just to say thanks Kai and the team and all the staff and, you know, Sandra and team, and Jake for sure, like great job putting this together and very helpful, so yeah.

And I don't know if our colleagues on the PUC have any comments as well.

PRESIDENT REYNOLDS: I'll just also jump in to say thanks. And I appreciated all the questions, especially ones related to just opportunities to ask further questions and look at a different angle, look at this from different angles, and especially with respect to ratepayer impacts. And so look forward to further discussion.

But I really appreciate the work that has been done at this point from Brattle. You know, we kind of have to make certain assumptions and create certain scenarios. We can't have an unlimited number of different future cases. And I feel like that there are some good ideas about some additional work, but I also feel like these scenarios that were selected are -- provide a good illustration of kind of the scale and then the different opportunities for benefits and harnessing benefits.

VICE CHAIR GUNDA: Yeah, thank you, President Reynolds and Commissioner McAllister. I think I just you know 100 percent agree with, you know, everything you guys both just said. And I think the important part as, you know, Brattle does this work and the state agencies are supporting this is to really you know provide, you know, strong, informed, directional insights as we move into these things.

And as President Reynolds, you know, kind of

noted, some of these things the variables you know it's really hard to test every sensitivity. But I think as state agencies and stakeholders, we have enough confidence to understand this is how directionally it will play out, that would be really helpful for us to think about, you know, our own perspectives and what we think needs to be done to de-risk those risks or other things you might see.

So again, I would say thank you again to Brattle. And I would really welcome as the stakeholders and everybody who are on the call today to provide comments in written form so that we can really think through how we can better inform. And at state agencies, I think our best role is to provide transparency and provide insights into, you know, how different policies might impact us in both beneficial ways but also, you know, put into risks that we have to think about how to de-risk.

So with that intent I, again, thank you all for taking the time to join us. Thanks Brattle. Thanks to all the staff for helping put this together.

And with that I'll pass it back to you, Sandra.

MS. NAKAGAWA: All right. Thank you everyone. So that concludes today's workshop. The recording will be available on the website. And here's the information if you would like to submit a comment to our docket on how to do that. Again, the deadline is June 19th by 5:00 p.m.

Thank you so much.

(The workshop adjourned at 3:08 p.m.)

CERTIFICATE OF REPORTER

I do hereby certify that the testimony in the foregoing hearing was taken at the time and place therein stated; that the testimony of said witnesses were reported by me, a certified electronic court reporter and a disinterested person, and was under my supervision thereafter transcribed into typewriting.

And I further certify that I am not of counsel or attorney for either or any of the parties to said hearing nor in any way interested in the outcome of the cause named in said caption.

IN WITNESS WHEREOF, I have hereunto set my hand this 28th day of September, 2025.

MARTHA L. NELSON, CERT**367

CERTIFICATE OF TRANSCRIBER

I do hereby certify that the testimony in the foregoing hearing was taken at the time and place therein stated; that the testimony of said witnesses were transcribed by me, a certified transcriber and a disinterested person, and was under my supervision thereafter transcribed into typewriting.

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I certify that the foregoing is a correct transcript, to the best of my ability, from the electronic sound recording of the proceedings in the above-entitled matter.

MARTHA L. NELSON, CERT**367

September 28, 2025