PSE IRP Feedback Report
Webinar 13: Market Risk Assessment, Stochastic Analysis, Preferred Portfolio and Clean Energy Action Plan, Overview of the CEIP and Public Participation
March 5, 2021

3/19/2021

The following stakeholder input was gathered through the online Feedback Form, from February 26 through March 12, 2021. PSE's response to the feedback can be found in the far-right column. To understand how PSE incorporated this feedback into the 2021 IRP, feedback will be incorporated as practicable into the filing of the Final 2021 IRP. This Webinar 13 Feedback Report and the Consultation Update will be provided into the meeting record on pse.com/irp and included into Appendix A of the Final IRP.

Feedback Form Date	Stakeholder	Comment	PSE Response
3/5/2021	Elyette Weinstein	Per Diane's suggestion at today's meeting presentation regarding the CEIP's Equity Advisory Groupc (EAG), I am posting the following suggestion: Once the risk of Covid transmission is effectively "over" per health experts, I recommend that the EAG travel to highly impacted communities and areas with vulnerable populations to hear from their residents. I have heard directly from members of these communities (of various races and ethnicities) that they respect outside groups who come to the turf of these highly impacted, vulnerable populations. They consider it a sign of respect and that the outside group takes the concerns of such populations seriously. In return, such populations are likely to be more upfront and cooperative with the EAG.	Thank you for the comment. We agree that connecting with people where they reside provides valuable insights into local conditions and interests. We are taking this into consideration as we develop our public participation plan and Equity Advisory Group plan, and will continue to do so in the future. In light of the COVID-19 pandemic, we anticipate EAG meetings will be virtual through at least the summer. We will consider in-person discussions when it is safe to do so for community members, the facilitation team and PSE staff.
3/7/2021	Bill Westre, Union of Concerned Scientists	I believe the planned use of Biodiesel as a natural gas substitute is ill advised. Bio-Fuels are and will be increasingly scarce. They are critically needed to reduce emissions in the transportation sector - aviation, shipping, truck and train that have fewer options than utilities. As a retired aircraft designer, I am familiar with the airline industries work. They have been instrumental in developing bio-fuels beginning in the early 2000's. They have demonstrated successful flight with them but have not demonstrated how to source the supply for 20,000 commercial aircraft that together burn 73 million gallons of fuel per day. PSE should question whether it can successfully compete in the purchase market with these other industries that need this resource much more. PSE should consider the ethical issues in using this fuel when it has other renewable options. Will PSE take a second and more informed look at this?	Thank you for your comments on biofuel. PSE acknowledges that biofuels, in particular biodiesel, have a number of drawbacks for use as a fuel source including supply concerns, unique combustion characteristics and cost. PSE has modeled biodiesel as possible alternative fuel for the 2021 IRP because the company believes that there may be adequate supply in the region to maintain resource adequacy during times of peak demand. Biodiesel fueled frame peakers would be fired sparingly to provide flexible capacity, not as a baseload resource. That said, PSE is actively investigating other fuel sources such as renewable natural gas and green hydrogen. PSE looks forward to including these fuels in future IRP cycles.
3/11/2021	Renewable Northwest	The letter dated March 11, 2021 submitted in the feedback form is uploaded as part of the Feedback Report, and provided in Appendix A of the Final IRP. A brief summary of salient questions and recommendations are provided below.	Thank you for your letter. PSE inserted the recommendation and questions from the letter along with PSE's responses below.
3/11/2021	Renewable Northwest	What updated resource assumptions resulted in a decrease in battery storage between the draft IRP and the final preferred portfolio? What replaced those procurements, if not renewable resources or flexible capacity?	The summary statistics provided on slide 42 of the March 5 webinar obscure some nuance in the changes in the preferred portfolio between the draft and final IRP. Most notably is the addition of 375 MW of wind + storage hybrid present in the final preferred portfolio which was absent from the draft plan. These hybrid resources "replace" the storage between the draft and final plans. Regarding why these changes occurred, as explained in the Feb 10 Webinar, several updates were incorporated into the final portfolio model including: updates to the flexibility benefit, corrected transmission costs, addition of a transmission and distribution benefit for storage resources and biomass build limits. These changes were incorporated simultaneously, so determining specific outcomes from each change is difficult. Each of these changes has the potential to impact build decisions from the long-term capacity expansion model. Additional details describing PSE's portfolio model methodology are included in the Consultation Update.
3/11/2021	Renewable Northwest	There appear to be fundamental problems with the inputs and/or design of PSE's portfolio modeling tool such that nonemitting capacity resources cannot compete with flexible capacity, and we insist the company determine the source of this resource skewing so that its preferred resource strategy is truly resource agnostic.	Please refer to the Consultation Update for additional modeling details demonstrating that all resources are evaluated consistently

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3/11/2021	Don Marsh, CENSE.org1	The letter dated March 11, 2021 and submitted in the feedback form and sent to PSE and the WUTC on March 12, 2021 is as part of the Feedback Report, and provided in Appendix A of the Final IRP. 1/ All signatories to the letter: Don Marsh, CENSE.org Doug Howell, Sierra Club Kevin Jones, Vashon Climate Action Group Court Olson, Green building consultant, member of Shift Zero, Chair of People for Climate Action Pete Stoppani, Indivisible Eastside David Perk, 350 Seattle Leadership Team Anne Newcomb Michael Laurie, sustainability consultant, owner of Watershed LLC Willard Westre, Union of Concerned Scientists Kate Maracas, Managing Director, Western Grid Group	Thank you for your letter. PSE inserted the recommendation and questions form the letter along with PSE's responses below.
3/11/2021	Don Marsh, CENSE.org1	The letter references slide 48 of the Webinar 13 presentation specifically and the excel Portfolio Summary Comparison. The letter states: "We commend PSE on increased transparency regarding these results. However, careful study of the spreadsheet has revealed significant flaws in the design and methodology of this study. These problems cast doubt on the conclusions."	PSE thanks you and the group for recognizing our improvements to the 2021 IRP stakeholder public participation process by providing additional data and increasing transparency.
3/11/2021	Don Marsh, CENSE.org1	Study flaw 1: Questionable metrics. The seven metrics shown in the above table determine the final score and overall ranking of each sensitivity. Some of the metrics are averages of rankings of other metrics. For example, "Environment" encompasses subcategories such as Utility Scale Renewable Generation, Energy Efficiency, Distribution Efficiency, Codes and Standards, DSP NWA, Rooftop Solar, Ground Solar, Customer net metering, and Customer Programs (Green Direct, Green Power, Qualifying Facilities). Some of these metrics matter more to customers and some less, but PSE weighs categories equally when calculating a final score for each sensitivity.	Thank you for your comments concerning the metrics used in the Customer Benefit Indicator Analysis. As PSE has stated previously, the customer benefit indicators selected for this analysis are preliminary and intended to open the discussion on which indicators are important to PSE's customers. PSE introduced this methodology in the February 10 webinar and incorporated stakeholder feedback following the webinar. The list of customer benefit indicators will be further developed and refined throughout the Clean Energy Implementation Plan process through public participation and insights from the Equity Advisory Group.
3/11/2021	Don Marsh, CENSE.org1	Study flaw 2: NOx emissions. Emissions of nitrogen oxides (NOx) are averaged with emissions of sulfur dioxide (SO2) and particulates (PM) to produce an "Air Quality" metric. Although NOx can combine with hydrocarbons to produce ground level ozone, this is not a major concern in the Puget Sound region. Puget Sound Clean Air Agency's Strategic Plan (https://www.pscleanair.gov/DocumentCenter/View/445/2014-to-2020-Strategic-PlanPDF?bidId=) states the most harmful pollutants in our region are fine particle pollution and air 2 toxics. When considering an IRP that strives to meet CETA targets, NOx emissions are not nearly as important as the Social Cost of Greenhouse Gases (SCGHG) and CO2 Emissions. Sulfur dioxide emissions may also be subcritical.	Thank you for your comments, see response above.
3/11/2021	Don Marsh, CENSE.org1	Study flaw 3: PSE ranks all the sensitivities with respect to a particular metric early in the analysis. This destroys meaningful distinctions between the sensitivities. For example, the cost difference between the two least expensive sensitivities is $34 million, while the difference between the two most expensive portfolios is $26 billion. Early ranking obscures the fact that the latter difference is 765 times larger than the former.	Thank you for your comments concerning the methodology used in the Customer Benefit Analysis. PSE will continue to work with customers and the Equity Advisory Group to refine the methodology used in the Customer Benefits Analysis. Your feedback will be taken under advisement during this process.
3/11/2021	Don Marsh, CENSE.org1	Study flaw 4: Averaging rank scores. After ranking is performed for each metric, all seven rank scores are averaged together to produce a composite score. Aside from the problem of treating each metric as equally important, the averaging process obscures another fact. Rank scores mean different things for different metrics. For example, the difference between rank 1 and rank 19 in the Customer Programs subcategory is 0.000004%. The difference between ranks 1 and 19 in Portfolio Cost is 208%. When the rank scores for these metrics are averaged together, the result is almost meaningless.	Thank you for your comments concerning the ranking of the Customer Programs indicator. PSE has revised the Customer Programs indicator to round to the nearest full MWh. Further methodological changes will be considered throughout the Clean Energy Implementation Plan process.
3/11/2021	Don Marsh, CENSE.org1	Study flaw 5: Puzzling data. We note that the Portfolio Cost for sensitivity M (Alternative Fuel for Peakers – Biodiesel) is the second least expensive sensitivity of this set. How can that be true, when the cost of biodiesel fuel was estimated	The contribution of a fuel to the revenue requirement of a portfolio is function of both the cost of the fuel and the quantity of fuel consumed. The frame peakers used to meet reliability (resource adequacy) in Sensitivity M (Alternative Fuel for Peakers) are fired with the relatively more

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		to be ten times higher than natural gas in the webinar? Is PSE assuming that natural gas is likely to be used instead of biodiesel for practical cost reasons.	expensive biodiesel, but at a much lower frequency than the equivalent frame peakers fired with natural gas in the Mid portfolio.
3/11/2021	Don Marsh, CENSE.org1	A better method: Stakeholders are developing a better method to score the sensitivities with the data PSE has provided in the spreadsheet. There has not been sufficient time to vet the new method before the deadline for comments, but we expect to publish the improved method soon. Initial results appear to produce a stronger preference for portfolios A and N1 compared to PSE's method. We believe it is possible to choose a portfolio that effectively meets CETA targets, avoids the uncertain availability and potential expense of biodiesel fuel, and keeps customer costs reasonable.	PSE looks forward to learning more about your improved Customer Benefit Analysis methodologies. Thank you for contributing your time and talents to this endeavor.
3/12/2021	Kyle Frankiewich, Washington Utilities and Transportation Commission	The letter dated March 11, 2021 and submitted in the feedback form and sent to PSE and the WUTC on March 12, 2021 is as part of the Feedback Report, and provided in Appendix A of the Final IRP.	Thank you for your questions and comments. PSE inserted each item below along with PSE's responses.
3/12/2021	Kyle Frankiewich, Washington Utilities and Transportation Commission	Slide 13: This slide is interesting but it is hard to understand whether what being compared connects to the assumption, which PSE is revisiting, that its access to the Mid-C market is limited by its transmission rights, rather than by the depth of the market itself. The differences could be explained by the fact that utilities have different service areas, different peak load needs, and different transmission rights to different market hubs. Do other utilities set the assumed market availability during seasonal peaks based on their transmission rights, or do they derate the assumed availability due to other factors?	PSE cannot speak to specific details associated with other utilities as each utility has its own unique resource adequacy methodology, resource procurement and hedging practices. However, the benchmarking provides a useful guide.
3/12/2021	Kyle Frankiewich, Washington Utilities and Transportation Commission	Slide 16: We appreciate the context, and agree that price volatility is an important part of the evaluation of market reliance risk. We note that none of the three events shown here match with a capacity planning standard connected to the company's winter peak.	Thank you for your comment. PSE's resource adequacy analysis evaluates the loss of load events across 8760 hours for a model year and although most of the loss of load events occur in the winter, there are also events that occur in the summer. The details of the resource adequacy analysis including the market risk assessment are provided in Chapter 7 of the final IRP.
3/12/2021	Kyle Frankiewich, Washington Utilities and Transportation Commission	Slide 17: The August 2020 event provides further evidence that PSE's winter system peak may not be the biggest reliability challenge in meeting load across the year. Does the graph on this slide represent PSE's market position in each hour? Are the purchases and sales not labeled "CAISO" all from Mid-C, or was PSE able to access other markets as well?	The graph represents the hourly sales/purchases for August 17, 2020. All bars not labeled CAISO represent energy sales or purchases at the Mid-C hub. The different colors show when the purchase or sale was made.
3/12/2021	Kyle Frankiewich, Washington Utilities and Transportation Commission	Slide 17: The presence of CAISO on this graph is fascinating for multiple reasons. If I recall correctly, PSE's IRP tools model a market price for Mid-C, but do not include contemplation of other possible markets or bilateral trading partners in the WECC. This graph demonstrates that, on an operational level, PSE procures resources from sources other than Mid-C. Please describe these transactions. How common are they? What is a representative estimate of these transactions' size and frequency? Has PSE attempted to include these potential market resources in its modeling? Given that non-Mid-C market resources mitigated the need to escalate PSE's stage 1 emergency, this event illustrates that other market resources can be a critical option in maintaining system reliability.	PSE only trades power at the Mid-C bilateral trading hub. On August 17, 2020, PSE was able to self-schedule a small amount of power export from the CAISO Balancing Authority Area (BAA) to support reliability requirements because no offers were available at the Mid-C hub. This transaction was not a market award and PSE does not participate in the CAISO Day Ahead market. Self-scheduled exports are unusual because they expose PSE customers to price risk and PSE does not include self-scheduled imports as a resource in its modeling.
3/12/2021	Kyle Frankiewich, Washington Utilities and Transportation Commission	Slide 18: What is the distinction between a 'capacity need' and a 'market risk adjusted capacity need'? Which of these needs will PSE's 2021 IRP preferred portfolio be tailored to meet?	PSE's preferred portfolio has been developed to meet all capacity, energy and renewable energy needs including market risk. PSE attempted to distinguish between the capacity need created by the market risk versus the resource adequacy analysis but recognizes that this new terminology created confusion. In the final IRP, PSE will use one capacity need view and not this new terminology presented at the webinar.

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3/12/2021	Kyle Frankiewich, Washington Utilities and Transportation Commission	Slide 18: Mr. Wetherbee's presentation included a discussion of real-time, day-ahead, and "forward" market purchases. Which types of market transactions present outsized risk during periods of shallow market depth? How is this linked to PSE's resource procurement strategy?	PSE's recent experience at the Mid-C bilateral trading hub is that power price volatility is most pronounced in the Day Ahead market and in Hour Ahead trading at the Mid-C hub or between other utility real time desks. PSE's procurement strategy seeks to reduce price volatility impacts to PSE customers by efficient use of forward contracts and optimized economic dispatch of PSE resources.
3/12/2021	Kyle Frankiewich, Washington Utilities and Transportation Commission	Slide 18: What does PSE mean by "market risk adjusted capacity need"? Why does PSE propose reducing its market reliance from 1500 MW to 500 MW, rather than some other value (800 MW, 200 MW, 0 MW)?	Please see the explanation of market risk adjusted capacity need above. Due to the confusion that this terminology has caused, PSE will not use it. PSE acknowledges that the wholesale electric market is experiencing tighter supply and increasing volatility and as a result we must change the way that we plan. PSE plans to reduce the market risk through the upcoming all-source RFP. The convergence of the RFP process and the development of the Northwest Power Pool (NWPP) resource adequacy program will provide additional useful guidance in the future.
3/12/2021	Kyle Frankiewich, Washington Utilities and Transportation Commission	Slide 21: This slide could probably be its own webinar. We have many questions, though at this stage of the IRP process, it may be too late to revisit the analysis even if stakeholder review identifies significant concerns in methodology. We will some of the questions below, as a representative sample of the level of detail that we would encourage the company to provide when completing the narrative description of the stochastic analysis in the final IRP. ○ What datasets were used for each data input? ○ How did the company represent the probability of outliers for each data input? Did the company assume a normal distribution for any or all inputs? How is distribution modeled? ○ Does the modeling account for any correlations across variables? For example, if there is a relationship between hydro generation and Mid-C prices, does the outcome of one 'draw' get factored into the possible outcomes for a related draw? ○ As participant Charlie Black asked, do the stochastic draws cover the entire IRP planning period, or does the stochastic modeling include draws at a more frequent timeline? We agree that a model run which assumes, for example, very bad (or very good) hydro for all 24 years of the planning horizon is an inaccurate (or at least exceedingly unlikely) representation of the possible futures that should be modeled in the stochastic analysis. ○ How are 310 iterations looking out 24 yrs Slide 22: As with Slide 21, staff would appreciate more details regarding how, exactly, the modeling is done.	Thank you for the recommendations on clarifying information to include in the Final IRP. PSE will address these details in Appendix G, Electric Analysis Models, of the Final IRP.
3/12/2021	Kyle Frankiewich, Washington Utilities and Transportation Commission	Slide 24: Do the 80 'draws' generated from the company's load forecast represent various percentiles of the main forecast, or was this done some other way? How did the company condense these key inputs into an aggregated 80 draws? We would like to explore whether boiling four important variables into one static 80-draw dataset might attenuate the variability that should be included in a robust stochastic analysis.	The Electric Price Forecast is an output of an AURORA simulation of the entire WECC, for more details on the Electric Price Forecast AURORA model see Chapter 8, Electric Analysis, and Appendix G, Electric Analysis Models, in the Final IRP. The 80 electric price forecast draws were generated through a stochastic analysis of the electric price model, where regional demand, fuel prices, hydro conditions and regional wind conditions were varied. In the Portfolio Model, these same inputs (and more) are varied at the PSE portfolio level of detail. Therefore, there was little risk of attenuating the variability of these inputs.
3/12/2021	Kyle Frankiewich, Washington Utilities and Transportation Commission	Slide 26: As we have highlighted before, we are concerned with the continued use of historical data stretching back almost 100 years in view of our changing climate. A representation of climate and weather patterns based on distant historical data is unlikely to produce an accurate forecast of weather and climate conditions in the next 24 years.	The objective of stochastic analysis is to model a variety of input conditions to understand the range of possible conditions in the future. For largely variable, complex systems such as hydro storages, historical data provides a reasonable estimation of future events. Many years of historical data provide coverages for the wide variety of conditions which may exist. The Pacific Northwest Coordination Agreement Hydro Regulation data have long been used by the energy industry in the PNW to estimate hydro variability. PSE is not currently aware of any forecast hydro data which meet these needs, but would be open to evaluating any data sources suggested by stakeholders.

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3/12/2021	Kyle Frankiewich, Washington Utilities and Transportation Commission	Slide 30: Does the frequency duration outage method in Aurora use historical outage rates for individual resources as an input? Are the outage rates adjusted for each plant based on historical performance, or based on recent maintenance or capital investment?	The frequency duration outage method in AURORA uses the most recent 4 years of historical outage data as an initial condition. The method also applies plant specific mean time to repair statistics.
3/12/2021	Kyle Frankiewich, Washington Utilities and Transportation Commission	Slide 31: Please see our comments for slide 21. Our line of questioning for the electric stochastic analysis also applies to the company's natural gas stochastic analysis.	Thank you for the recommendation on content for the IRP. These components will be incorporated into Chapter 9, Natural Gas Analysis, and Appendix I, Natural Gas Analysis Results, of the Final IRP.
3/12/2021	Kyle Frankiewich, Washington Utilities and Transportation Commission	Slide 35: We appreciate this interesting way to represent this comparison.	Thank you for your positive statement concerning slide 35.
3/12/2021	Kyle Frankiewich, Washington Utilities and Transportation Commission	Slide 42: What assumptions regarding transmission to WY and MT resources were changed? What prompted these changes? Also, we echo participant Katie Ware's question: what updated assumptions resulted in a decrease of battery storage? What replaced those procurements, if not renewables or "flexible capacity"?	PSE would clarify that fixed transmission costs for Wyoming and Idaho resources were updated between the Draft and Final IRP. Montana fixed transmission costs have not adjusted. Fixed transmission costs for WY and ID were increased following new insights into transmission availability and costs for the region. Variable transmission costs were added for all resources, following solidification of methodologies for cost estimation. Please refer to the Consultation Update for additional modeling details demonstrating that all resources are evaluated consistently.
3/12/2021	Kyle Frankiewich, Washington Utilities and Transportation Commission	Slide 46: For clarity, please describe the source of forecasted emissions associated with PSE's electric system in 2045, and describe the modeled approach to offsetting these emissions.	The emissions may be associated with market purchases and dispatch of thermal resources. PSE used the cost associated with the California carbon price as a proxy to reflect alternative compliance mechanisms, as this may align with the requirement for greenhouse gas neutral electricity. The forecasted prices start at over $34 per MWh in 2030 and increase to $59 per MWh in 2044.
3/12/2021	Kyle Frankiewich, Washington Utilities and Transportation Commission	Slide 51: We appreciate the year-by-year breakout and the inclusion of flexible capacity in this chart. Do any of these resources make use of the 1500 MW of transmission capacity to Mid-C, effectively displacing market purchases?	The results of the market risk sensitivity will be available in Chapter 8, Electric Analysis,of the Final IRP.
3/12/2021	Kyle Frankiewich, Washington Utilities and Transportation Commission	Staff recommendation 1: **Market risk capacity need adjustment** – While we agree PSE that the company's reliance introduces price and reliability risk, the analysis provided in this presentation does not provide us with a quantification of this risk, nor does it particularly support the company's implicit proposal of 500 MW as a target which appropriately balances the risks and benefits that come with market reliance. We were also left with questions regarding whether the company's representation of the dwindling spot market connect directly with PSE's ability to procure energy and/or capacity through other contract arrangements. On slides 15 -17 the	Thank you for your comments. PSE recognizes that some elements of this IRP are completed late in the process. The implementation of CETA into PSE's IRP was a significant challenge. PSE will provide an expanded discussion of the market risk assessment along with an updated resource adequacy analysis and stochastic analysis results in the Final IRP to support the market risk recommendation.

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		company shows a reduction in trading volume and increasing price volatility for what we understand to be day-ahead markets, but the company does not provide similar data for the forward market, which we understand to be longer-duration contracts and which, if we understand correctly, comprises a large share of the 1500 MW of capacity the company assumes it can acquire. It is unfortunate that the market reliance analysis and the stochastic analysis will be seen for the first time by staff and other stakeholders in the final IRP. We encourage the company to include sufficient analysis demonstrating that the company's proposed market reliance target – whether it is 500 MW or some other number – reasonably balances the costs and benefits that come with market reliance.	
3/12/2021	Kyle Frankiewich, Washington Utilities and Transportation Commission	Staff recommendation 2: **Stochastic risk analysis -** Staff understands that PSE is letting AURORA stochastically select a single gas price, water year, market price, force outage rate, load growth rate, etc. for the entire planning period for each future it tests, rather than using the values for each of these variables that were used to develop the "optimized" portfolio. We believe that a much better approach is to let AURORA select a different value for each "variable" each year of the planning period. This is how the real world operates, and is consistent with the NWPCC's methodology. We recommend that the company investigate, in collaboration with staff and stakeholders, how to improve its approach to stochastic risk analysis for the next IRP. On the natural gas side, we appreciate PSE's comparisons across each optimized resource portfolio's composition to see how that might change across alternative futures. While it would be a heavy lift, and it is too late for this IRP cycle, we believe a similar analysis could be done for the electric line of business.	Thank you for the recommendation. PSE acknowledges that inputs which vary year-to-year as well as simulation-to-simulation would provide a more nuanced analysis. PSE will explore opportunities to incorporate these changes into future IRP cycles. For the 2021 IRP, PSE suggests that static inputs as modeled still provide meaningful results and adequately bracket the upper and lower bounds of expected results as well as insight into various possible futures.
3/12/2021	Kyle Frankiewich, Washington Utilities and Transportation Commission	Staff recommendation 3: **Comparative Cost of GHG Emissions Reduction -** While PSE provided multiple slides (43-47) on the level of emissions by resource portfolio, it would be very informative if it also reported a $/ton of reduction achieved by each portfolio. For example, slide 44 shows that the preferred portfolio has a NPV of $16.11 billion and produces emissions of around 0.6 million short tons in 2045 without counting market purchases and just about 1.8 million short tons with market emissions. The preferred portfolio has an NPV of roughly $580 million more than the M-1 portfolio and produces 200,000 short tons less emission in 2045. PSE should compare the cumulative emissions difference between the two portfolios over the entire 24 year planning period. The cost per ton of emissions reduction across each of the portfolios would provide the commission and stakeholders with a point of comparison with other options (i.e., securing other CETA-compliant credits or offsets, rather than building more renewables and storage or biodiesel fuel) for CETA compliance.	Thank you for the metric recommendation. PSE will include this information in the Final IRP. PSE will include a table of the cost of greenhouse gas emissions ($/ton) by sensitivity in Appendix H. This metric will also be discussed in related sensitivity analyses within Chapter 8.
3/17/2021	Orijit Ghoshal, Invenergy	The letter dated March 17, 2021 and submitted to Michele Kvam is as part of the Feedback Report, and provided in Appendix A of the Final IRP. A brief summary of salient questions and recommendations are provided below.	Thank you for your comments.
3/17/2021	Orijit Ghoshal, Invenergy	Market Risk Analysis – "…the late change in PSE's methodology has prevented stakeholders from assessing whether PSE's methodology is reasonable. PSE has not adequately demonstrated that it can prudently wait until 2027 to reach a level of 500 megawatts of market reliance by making reductions of 200 megawatts per year. Further, during Webinar #13, PSE did not present any information about how the resulting 1,000 MW increase in its need for new capacity will affect its preferred resource strategy. Instead, PSE stated that the impacts on its resource strategy will be included in the final IRP. This blocks meaningful review and comment by stakeholders and is simply unacceptable."	Thank you for your comments. PSE recognizes that some elements of this IRP are completed late in the process. The implementation of the Clean Energy Transformation Act (CETA) into PSE's IRP was a significant challenge. PSE will provide an expanded discussion of the market risk assessment along with an updated resource adequacy analysis and stochastic analysis results in the Final IRP to support the market risk recommendation.
3/17/2021	Orijit Ghoshal, Invenergy	Electric Stochastic Analysis – "…the purpose of stochastic analysis is to incorporate the effects of short-term variability in key inputs such as natural gas prices, hydroelectric electric conditions and electric loads, PSE's analysis does not adequately reflect the impacts of the stochastic variables. This is due to oversimplification of how the stochastic variables are input and used in PSE's model. As a result, the model's outputs do not accurately reflect the impacts of stochastic variabilities. …	Thank you for your comments. PSE acknowledges that inputs which vary year-to-year as well as simulation-to-simulation would provide a more nuanced analysis. PSE will explore opportunities to incorporate these changes into future IRP cycles. For the 2021 IRP, PSE suggests that static inputs as modeled still provide meaningful results and adequately bracket the upper and lower bounds of expected results as well as insight into various possible futures.

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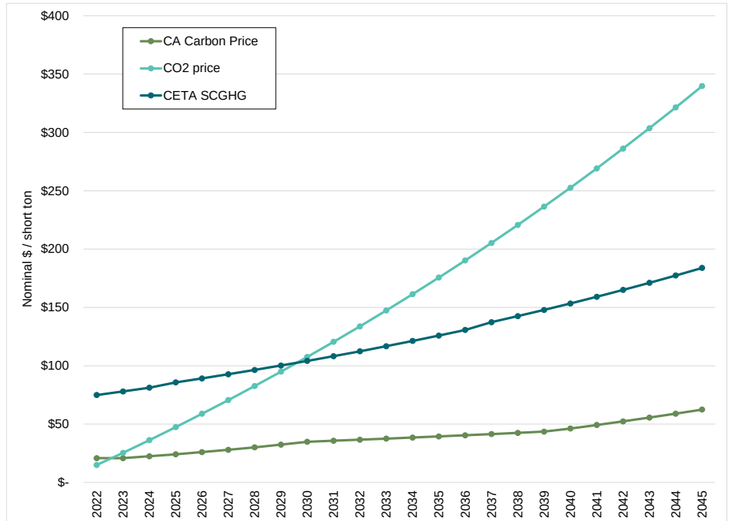
		Further, during Webinar #13, PSE did not present any results for its electric stochastic analysis. Instead, PSE stated that the results will be included in its 2021 IRP filing on April 1, 2021. This is another example of how PSE is not providing timely information for review and comment by stakeholders."	PSE recognizes that some elements of this IRP are completed late in the process. The implementation of CETA into PSE's IRP was a significant challenge. PSE will provide an expanded discussion of the stochastic analysis throughout the Final IRP.
Questions from the Webinar requiring follow-up			
3/5/2021	Joni Bosh	Slide 41 – Is there some reason the chart on slide 41 does not coordinate with the CEIP time periods? The second time period covers 2026 through 2029, not 2030.	PSE contacted Joni Bosh on March 10 to communicate the minor corrections to slides posted on March 9. The time periods on slide 41 represent key points along the CETA timeline including retirement of coal resources, the 2030 emissions target and the 2045 clean energy target.
3/5/2021	Katie Ware	Slide 42 - I still don't understand what updated assumptions resulted in reduced battery storage. And if 1500 MW market purchases are assumed, I don't understand how market purchases replaced storage. New question -- I presume you have completed your sensitivity analysis on the 2% cost threshold. How did that sensitivity inform these modified resource additions?	Please refer to the Consultation Update for additional modeling details. Based on stakeholder feedback received in response to Webinar #12, PSE will not use the 2% cost threshold to adjust the preferred portfolio.
3/5/2021	Charlie Black	Slide 48 – What prices is PSE assuming for its intended purchase of GHG emissions allowances from the CARB auctions?	PSE used the California carbon price as a proxy, as this may align with the requirement for greenhouse gas neutral electricity. The forecasted prices start at over $34 per MWh in 2030 and increase to $59 per MWh in 2045 , see green line on the graph below. The graph below is also included in Chapter 5 of the Final IRP. 
3/5/2021	Anne Newcomb	Slide 51 – Do you think it is possible the modeling tool could be favoring gas as well?	PSE attempts to model all resources as fairly and true to life as feasible. PSE's portfolio model appears to select 2-hr lithium ion batteries more often than other battery storage technologies, which led PSE to state that the model may favor this resource. As an emerging technology, battery storage resources pose unique challenges to the modeling process including accurate cost estimations, flexibility benefit assumptions and dispatch logic. PSE is actively working to ensure these factors and others are properly balanced between all resources.

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			While still complex to model, thermal resources are a well-established technology, with established modeling practices, PSE is confident the assumptions for the thermal resource options are well designed and representative of real-world applications. PSE would not suggest that there is any bias toward selection of thermal resources. However, model constraints such as resource adequacy favor flexibility and reliability of thermal resources over non-dispatchable resources.