

The CAISO received comments on the topics discussed at the January 4, 2024 stakeholder call from the following:

- A. Avangrid Renewables
- B. Avantus Clean Energy LLC
- C. Bay Area Municipal Transmission Group (BAMx)
- D. California Public Utilities Commission - Public Advocates Office
- E. California Western Grid Development, LLC
- F. Center for Energy Efficiency and Renewable Technology
- G. Fervo Energy
- H. Gallatin Power Partners, LLC
- I. Golden State Clean Energy
- J. Invenergy
- K. LSA
- L. RWE Renewables
- M. TransWest Express LLC

Copies of the comments submitted are located on the Transmission Planning Process page at:

<https://stakeholdercenter.caiso.com/RecurringStakeholderProcesses/20-Year-transmission-outlook-2023-2024>

The following are the CAISO's responses to the comments

1. [Please provide your organizations comments on the approach to out-of-state wind resources.](#)
2. [Please provide your organizations comments on the approach to offshore wind resources.](#)
3. [Please provide your organizations comments on the high level technical assessment scenarios, mapping of resources, load forecast and dispatch.](#)
4. [Please provide your organizations comments on the preliminary results of the HSN scenarios.](#)
5. [Please provide any additional comments your organization has on the 20-Year Transmission Outlook update.](#)

1. Please provide your organizations comments on the approach to out-of-state wind resources.

No	Submitting Organization	Comment Submitted	CAISO Response
1A	Avangrid Renewables	<p>Avangrid supports the inclusion of out of state wind resources in CAISO's plan and believes that building new transmission to import incremental out of state wind resources is a cost effective and feasible addition to California's generation mix that will allow the state to reach long term energy goals. High capacity factor out of state resources, even after the necessary transmission buildout, can bring complementary benefits to the existing system such as regional diversity and clean generation at times of peak needs. The level of out of state wind resources being studied are reasonable and aligned with the results of the CPUC's IRP process.</p> <p>As a transmission developer, Avangrid recommends that the CAISO consider permitting feasibility in addition to cost when considering potential interconnection points for new transmission to import out of state wind. This consideration should be made when determining whether new transmission for out of state wind should interconnect at the CAISO border or at interconnection points within the CAISO system that are closer to load. Along with cost and reliability considerations, the CAISO must also consider the impacts of potential delays to the resource buildout required to decarbonize California's energy supply within the timeline mandated by the state legislature. Taking feedback from developers and other parties regarding the feasibility of interconnection to points within the CAISO system will help to prioritize interconnection options for out of state wind in the 20 year plan. This input could include the use of existing technologies to reduce the impact that new transmission lines would have to highly congested paths, such as the use of HVDC technology.</p> <p>When considering whether new transmission for importing out of state wind should interconnect at the CAISO border or at interconnection points deeper within the CAISO system, the CAISO should take into consideration multiple aspects that will have an impact in the viability of out of state wind resources:</p> <ul style="list-style-type: none"> Any new transmission project built to deliver out of state wind from New Mexico, Wyoming or Idaho to the CAISO market would need to complete a multi-state permitting process in at least two states outside of California. Permitting more than 100 miles of additional new transmission through California to reach interconnection points deeper within the CAISO 	<p>The comment has been noted.</p> <p>The 20-year transmission outlook analysis focuses on the technical assessment to gain an insight into the system enhancement options required to reliably serve the CEC forecast load and connect the resources in the CPUC portfolio. More detailed analysis will be performed as part of the Tariff-based 10-year transmission planning process and the optimum solution will be recommended for approval. Such detailed analysis will be performed in coordination with state agencies and takes into account permitting feasibility.</p> <p>The comment has been noted.</p>

No	Submitting Organization	Comment Submitted	CAISO Response
		<p>system closer to load would add significant cost, risk, and complexity to these potential new transmission projects, which already face a long and complex permitting process.</p> <ul style="list-style-type: none"> It is likely more expedient from a permitting perspective to optimize the use of existing right of ways than it would build new transmission through California to interconnection points that are closer to load centers within the CAISO system such as those being considered in this initiative for the Tesla and Lugo substations. CAISO should take stakeholder feedback on permitting considerations into account when planning for which interconnection points for out of state wind resources are optimal. <p>In addition, the CAISO border intertie location selected for out of state wind must consider the permitting feasibility and transmission availability in neighboring states. As an example, CAISO is considering mapping New Mexico wind imports to interconnection points in the SCE Eastern Transmission Zone, which may not be the most feasible or cost-effective location. To deliver incremental New Mexico wind to the CAISO at interconnection points in this transmission zone, new transmission would need to be routed through the densely populated metropolitan areas of southern Arizona, as there is no remaining room on the existing transmission system to wheel the energy from east of Phoenix to the CAISO system. Any new transmission built to deliver New Mexico wind to California would need to be permitted and built through Arizona, so minimizing the impacts of this new transmission in Arizona should be considered in the CAISO's planning processes.</p>	<p>A high level assessment will be performed in the 20-year outlook to provide an insight into the impact of injecting out of state wind at different locations. The detailed analysis that will be performed in the Tariff-based 10-year analysis will consider many other factors prior to recommending a project for approval.</p>
1B	Avantus Clean Energy LLC	<p>Avantus Clean Energy (Avantus) appreciates the opportunity to provide comments to the ISO's 20-Year transmission outlook. Avantus offers the following comments:</p> <ol style="list-style-type: none"> Avantus supports building new 500 kV transmission lines to accommodate up to 12,000 MW of out-of-state wind generation by bringing those lines either up to California border or at designated POIs inside California. <p>Have you identified how many new substations will be needed inside and outside California to bring 12,000 MW into California and at what locations?</p>	<p>The 2045 Portfolio has identified the interconnecting substations for 5,618 MW of out of state wind. The ongoing analysis in the 20-year outlook will identify the required system enhancements to integrate</p>

No	Submitting Organization	Comment Submitted	CAISO Response												
			the 6,382 MW that are not mapped to any substations in the 2045 Portfolio.												
1C	Bay Area Municipal Transmission Group (BAMx)	<p>The Bay Area Municipal Transmission Group (BAMx) appreciates the opportunity to comment on the CAISO 20-Year Transmission Outlook (20-Year Outlook, hereafter) presented at the CAISO Stakeholder meeting on January 4, 2024. BAMx acknowledges the significant effort of the CAISO staff in developing this material.</p> <p>Out-of-State (OOS) Wind Resources Modeling Appears to Be Consistent with Other Planning Forums</p> <p>Nearly 12,000 MW of OOS wind is included in the 20-Year Outlook portfolio, which is the same amount as the last 20-Year Outlook.^[2] Out of this amount, about 11,210 MW of OOS wind needs to be accommodated on new transmission. We understand that this assumption is based on the SB 100 starting point scenario. BAMx compared the OOS wind resource capacity modeled in the 20-year outlook portfolio with the Draft 2024-2025 Transmission Planning Process (TPP) portfolio^[3], as summarized in Table 1 below. The OOS wind capacity requiring new transmission assumed in the 20-Year Outlook appears to align with the latest assumptions in the Draft 2024-2025 TPP portfolio.</p> <p>Table 1: OOS Wind Capacity (MW) on New Transmission: 20-Year Outlook vs. Draft 2024-2025 TPP</p> <table border="1" data-bbox="514 1057 1199 1484"> <thead> <tr> <th data-bbox="514 1057 661 1177">OOS Wind Location</th> <th data-bbox="661 1057 993 1177">20-Year Outlook in 2045</th> <th data-bbox="993 1057 1199 1177">Draft 2024-2025 TPP in 2039</th> </tr> </thead> <tbody> <tr> <td data-bbox="514 1177 661 1279">Idaho</td> <td data-bbox="661 1177 993 1279">1,000</td> <td data-bbox="993 1177 1199 1279">1,204</td> </tr> <tr> <td data-bbox="514 1279 661 1377">Wyoming</td> <td data-bbox="661 1279 993 1377">5,000</td> <td data-bbox="993 1279 1199 1377">4,500</td> </tr> <tr> <td data-bbox="514 1377 661 1484">New Mexico</td> <td data-bbox="661 1377 993 1484">5,210</td> <td data-bbox="993 1377 1199 1484">4,500</td> </tr> </tbody> </table>	OOS Wind Location	20-Year Outlook in 2045	Draft 2024-2025 TPP in 2039	Idaho	1,000	1,204	Wyoming	5,000	4,500	New Mexico	5,210	4,500	
OOS Wind Location	20-Year Outlook in 2045	Draft 2024-2025 TPP in 2039													
Idaho	1,000	1,204													
Wyoming	5,000	4,500													
New Mexico	5,210	4,500													

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		Total	11,210	10,204	<p>The high level assessment in the 20-year outlook focuses on reliability (thermal overload) and how different transmission alternatives could address the identified reliability issues along with a high level cost estimate for the alternatives.</p> <p>The comment has been noted.</p>
1D	California Public Utilities Commission - Public Advocates Office	<p>A High-Level Benefit-Cost Analysis of Transmission Alternatives to Access OOS Wind is Necessary</p> <p>During the January 4th presentation, the CAISO indicated that the new transmission projects could either bring the OOS wind to the border of the CAISO system, requiring additional transmission within the CAISO system, or could be brought to interconnection points within the CAISO, such as Tesla and Lugo substations as examples. Any high-level assessment of both alternatives performed as part of the 20-Year Outlook assessment should compare the potential additional reliability and economic benefits associated with internal connections like the Tesla and Lugo termination options versus the total cost of the connections to the border and required internal upgrades. Such benefit-cost assessment should also compare HVDC versus AC options associated with each of the alternatives.</p> <p>Need to Layout Other Relevant Proposed OOS Transmission Projects</p> <p>It was unclear from the CAISO January 4th presentation whether the CAISO has assumed any of the following relevant OOS transmission projects, including but not limited to Gateway, Boardman-Hemingway, Green Link Nevada, etc. These projects will likely have an impact on the need for additional transmission projects to access OOS resources into CAISO. BAMx, therefore, requests the CAISO to include the details on how the inclusion of these OOS transmission projects impacts its findings in the Final 20-Year Outlook.</p>			

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1E	California Western Grid Development, LLC	California Western Grid has not comment on out-of-state wind resources																									
1F	Center for Energy Efficiency and Renewable Technology	<p>The Center for Energy Efficiency and Renewable Technologies (CEERT) strongly supports the development of out-of-state wind resources to provide a balanced portfolio of affordable renewable resources for California. CEERT supports the development of a geographically diverse mix of out-of-state wind resources.</p> <p>CEERT is concerned that the resource portfolio being proposed for use in the 20-Year Transmission Outlook study is not closely aligned with the proposed 2024-2025 TPP base case portfolio when it comes to the locations of future wind resources that are being planned for development. CEERT recommends that the CAISO in consultation with state energy agencies take steps to assure a reasonable consistency between resource portfolios used for the 20-Year Transmission Outlook and the 2024-2025 Transmission Planning Process.</p> <p>It will be less useful for multiple stakeholders if the CAISO decides to model a portfolio for 2045 that is widely variant from the TPP base case portfolio for 2034 and 2039 that is expected to drive near- and medium-term resource procurement and transmission expansion.</p> <p>The following table clearly shows the misalignment for in-state and out-of-state wind portfolios.^[1] CEERT recommends that the 20-Year Transmission Outlook model more in-state resources.</p> <p style="text-align: center;">Table 1 Land-Based Wind Resources</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Resource Type</th> <th>24-25 Base Case Portfolio (2034)</th> <th>24-25 Base Case Portfolio (2039)</th> <th>20 Year Outlook (2045)</th> </tr> </thead> <tbody> <tr> <td>In-State Wind</td> <td>6,123</td> <td>7,023</td> <td>3,074</td> </tr> <tr> <td>Idaho Wind</td> <td>1,060</td> <td>1,060</td> <td>-</td> </tr> <tr> <td>New Mexico Wind</td> <td>2,131</td> <td>3,536</td> <td>5,329</td> </tr> <tr> <td>Wyoming Wind</td> <td>2,905</td> <td>4,500</td> <td>6,671</td> </tr> <tr> <td>Total</td> <td>12,219</td> <td>16,119</td> <td>15,074</td> </tr> </tbody> </table>	Resource Type	24-25 Base Case Portfolio (2034)	24-25 Base Case Portfolio (2039)	20 Year Outlook (2045)	In-State Wind	6,123	7,023	3,074	Idaho Wind	1,060	1,060	-	New Mexico Wind	2,131	3,536	5,329	Wyoming Wind	2,905	4,500	6,671	Total	12,219	16,119	15,074	<p>The 20-year outlook study is based on the 2045 portfolio provided by CPUC. As reflected in Table 1 in comment 1C above, there is close alignment between 2045 portfolio and the 2039 portfolio with regards to out of state wind. Any future 20-year outlook will be based on an updated CPUC portfolio which may include different levels of in-state wind and other types of resources.</p>
Resource Type	24-25 Base Case Portfolio (2034)	24-25 Base Case Portfolio (2039)	20 Year Outlook (2045)																								
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		<p>The difference in the amount and locations of wind resources will impact the study results and the need for transmission system expansion. CEERT believes that the 2024-2025 TPP Base Case portfolio should be given additional weight in guiding the transmission study process for the 20-Year Transmission Outlook report.</p> <p>CEERT strongly urges the CAISO to work with the California Public Utilities Commission and the California Energy Commission to correct this misalignment between resource portfolios.</p>	
1G	Fervo Energy	No Comment	
1H	Gallatin Power Partners, LLC	<p>Gallatin Power Partners, LLC (“Gallatin Power”) appreciates CAISO’s efforts in the 20-Year Transmission Outlook to strategically plan for long-term transmission while aligning with California’s clean energy goals amidst the surging energy demand of the state and the West. Having closely followed the CAISO Transmission Planning Process and 20-Year Transmission Outlook, and associated processes by the California Energy Commission (“CEC”) and the California Public Utilities Commission (“CPUC”), it is evident that the limited CAISO connections to bordering regions present significant transmission bottlenecks and pose a threat to future planning and resource additions.</p> <p>The constraints of the Eldorado-Lugo 500 kV connection have become increasingly apparent, especially with the planned importation of 3,171 MW of out-of-state wind through this system; 671 MW on existing transmission, 1,500 MW on TransWest Express, and 1,000 MW on SWP North. The 20-Year Transmission Outlook rightly identifies the need for new transmission projects to bring the additional 3,500 MW of Wyoming and 2,900 MW of New Mexico wind called for in the planning portfolio into the CAISO system. Gallatin Power supports CAISO’s approach to studying out-of-state wind interconnection delivery points within the ISO system, such as the Lugo Substation, as opposed to only studying importation along the Eldorado-Lugo 500 kV connection. Furthermore, Gallatin Power supports CAISO’s suggestion for collaborative efforts between CAISO, LADWP, and BANC to identify new transmission projects which would diversify access to not only out-of-state wind, but also out-of-state solar and geothermal resources.</p> <p>Gallatin Power underscores the importance of studying out-of-state resources connecting within the CAISO system to spur new transmission and resource development outside of the highly</p>	<p>The comment has been noted.</p> <p>The comment has been noted.</p> <p>The comment has been noted.</p>

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		<p>congested Southern Nevada region. While recognizing the existing constraints of the Eldorado-Lugo 500 kV system and the limitations of any future upgrades, it is crucial to consider alternative geographic connections to alleviate congestion and improve access to currently stranded renewable resource locations, particularly in Central and Northern Nevada, including Esmeralda County.</p> <p>The wind potential in Central and Northern Nevada is clearly illustrated in a map prepared by the U.S. Department of Interior (“DOI”), Bureau of Land Management (“BLM”) and Argonne National Laboratory titled “Wind Resources, Exclusions, and Resource Sensitives on BLM-Administered Lands in Nevada”^[2], which indicates fewer permitting considerations for the region compared to Southern Nevada. The substantial amount of BLM land with a “Moderate” level of siting considerations, especially in Central and Northern Nevada, is a testament to the untapped wind resources available. As of November 2023, the BLM Mineral & Land Records System showed 22 active Nevada wind projects within the BLM Bristlecone Field Office, Eagle Lake Field Office, Tonopah Field Office, and Wells Field Office territories.^[3] As of December 12, 2023 the Nevada Energy Interconnection Queue showed 960 MW of wind interconnection applications in Esmeralda County, NV alone.</p> <p>Central and Northern Nevada also have substantial potential for geothermal energy generation, as highlighted by the National Renewable Energy Laboratory map titled “Geothermal Resources of the United States”^[4] depicting favorability for Geothermal Potential in the greater Nevada area. Favorability is generally greatest in Northwestern Nevada, with high favorability ratings beginning in Esmeralda County and northwest Nye County and continuing to the north. Esmeralda County can be viewed as the gateway for California into the strongest geothermal potential area in Nevada, directly abutting Mono and Inyo counties to the east. Geothermal development interest is already very high in Nevada. On November 14, 2023, the BLM held a competitive lease auction for geothermal leases,^[5] predominantly in Central and Northern Nevada, through which 96,605.5 acres of BLM lands were secured by geothermal developers.^[6]</p> <p>Esmeralda County is also a center for solar development in Nevada. As of December 12, 2023 in Esmeralda County alone the Nevada</p>	<p>The comment has been noted.</p> <p>The comment has been noted.</p> <p>The comment has been noted.</p>

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		<p>Energy Interconnection Queue showed 9,400 MW of applications for solar + BESS projects and 1,000 MW of applications for BESS projects and the CAISO Cluster 15 Queue showed 1,000 MW of applications for solar. As of November 2023, there were 14 active applications for large-scale solar and storage facilities on BLM lands in Esmeralda totaling over 11,000 MW. The Esmeralda County area is particularly attractive for solar development due to its strong solar resource, low environmental and cultural sensitivity and the low-cost land lease rates available on BLM lands.</p> <p>Furthermore, as of January 2024 almost the entire state of Nevada is designated as an Energy Community according to the U.S. Department of Energy – Energy Community Tax Credit Bonus website.^[1] This classification renders the region eligible for bonus Investment Tax Credit (“ITC”) and Production Tax Credit (“PTC”) under the Inflation Reduction Act. Leveraging the federal Energy Community bonus incentive would lead to lower cost renewable energy resources for California ratepayers.</p> <p>Given the substantial resource potential and amount of development activity in Central and Northern Nevada, Gallatin Power would like to again express its support of the CAISO’s approach to studying out-of-state wind interconnecting directly into the CAISO system at the Lugo Substation. This approach may spur additional transmission development while also strengthening the North of Lugo (“NOL”) area in California towards Nevada. CAISO has already identified and approved incremental transmission projects in the NOL area, which when combined and optimized could enhance access to Central and Northern Nevada’s abundant resources. Notably, the 2022-23 CAISO TPP approved upgrades to the Southern California Edison (“SCE”) Kramer-Victor-Lugo 230kV Transmission System, indicating a path toward accommodating a greater influx of resources from the NOL area. An upgrade to 500kV was also studied and had an estimated cost of \$700 million, a relatively small incremental cost compared to the \$482 million for the approved 230kV upgrades.</p> <p>SCE is also currently in the CPUC/CEQA permitting process for the Ivanpah-Control 115kV upgrade project to meet transmission line safety and reliability requirements, which includes a rebuild of the system from the Control Substation near Bishop, California (roughly 50 miles from the Nevada border) to the Kramer Substation. SCE has</p>	<p>The comment has been noted.</p> <p>The comment has been noted.</p> <p>The comment has been noted.</p>

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		<p>already completed environmental and cultural studies for this upgrade and has made substantial progress in the permitting process.</p> <p>The currently contemplated Control to Kramer 115kV rebuild and the Kramer-Victor-Lugo 230kV upgrades could be “leapfrogged” and instead upgraded to 500kV or High Voltage DC (“HVDC”) lines to help accommodate an additional CAISO interconnection point for out-of-state resources. By taking advantage of already approved upgrades, existing right-of-way and the significant environmental and permitting work already underway, increasing transmission access from the NOL area towards Nevada could be completed in a more timely and lower cost manner when compared to building a greenfield transmission line to access out of state resources elsewhere.</p> <p>Further, the 2022 CAISO 20-year Transmission Outlook identifies a Lugo to LA Basin HVDC upgrade at an estimated cost of \$1 billion as necessary to meet the requirements of SB100. Considering this identified future upgrade at Lugo Substation, it may be appropriate to build HVDC lines from Control Substation to Lugo Substation. These three identified upgrades present an opportune foundation to develop a robust transmission network into Nevada through the NOL study area, providing access to a diverse range of low-cost out-of-state renewable resources in a timely manner.</p> <p>Gallatin Power believes that CAISO’s approach to studying out-of-state wind directly interconnecting to the CAISO system in the Lugo area is a strategic and pivotal step in facilitating an additional CAISO transmission access point for out-of-state resources. This approach not only spurs transmission development, but it also provides a planning path towards accessing currently stranded renewable resources in Central and Northern Nevada. In addition, CAISO could leverage already identified and approved incremental transmission upgrades. By mitigating congestion between Southern Nevada and the Los Angeles Basin with a diverse interregional connection point it contributes significantly to the improvement of the Western Interconnection by enhancing overall resiliency and reliability of the system.</p>	<p>The transmission concepts in the 20-year outlook are based on a high level assessment to provide an insight into transmission needs in the long term. The exact scope of any future project will be determined in detail reliability, policy, and economic studies performed in the Tariff-based annual transmission planning process.</p> <p>The comment has been noted.</p> <p>The comment has been noted.</p>
1I	Golden State Clean Energy	No comment	
1J	Invenergy	No comment	
1K	LSA	No comment	

No	Submitting Organization	Comment Submitted	CAISO Response
1L	RWE Renewables	No comment	
1M	TransWestExpress LLC	<p>TransWestExpress LLC ("TransWest") appreciates the opportunity to provide comments on the proposed approach to out-of-state wind resources within the 20-Year transmission outlook update. TransWest requests a correction to the information provided about the TransWest Express Project in the presentation and suggests a minor revision to better describe the modeling approach.</p> <p>TransWest has designed the TransWest Express Transmission Project ("TWE Project") to bring Wyoming wind resources to the ISO system in Nevada near the Harry Allen 500 kV substation. The table on slide eighteen (18) identifies "Eldorado 500 kV" as the ISO interconnecting substation for the TWE Project. However, the table and other references to the TWE Project should be updated to list "Harry Allen 500 kV" as the ISO substation to be consistent with the current configuration of the TWE Project. TransWest has been working with CAISO, Participating Transmission Owner's and other utility planners to complete WECC, TPP and interconnection studies to connect the TWE Project to Harry Allen - Eldorado 500 kV transmission line near the Harry Allen and Crystal substations northeast of metropolitan Las Vegas. The 500 kV interconnection substation has been designated within these studies as the Muddy 500 kV Switching Station. For the purposes of the 20-Year transmission outlook work, "Harry Allen 500 kV" substation will be more appropriate.</p> <p>In addition, TransWest is developing a 49-mile, 500 kV transmission line segment from the Harry Allen/Crystal Area to the Eldorado Valley southeast of metropolitan Las Vegas. This segment is within the existing CAISO system and is in parallel with the Harry Allen - Eldorado 500 kV line and could serve, if found needed through the TPP, as a Harry Allen - Eldorado No. 2 500 kV line.</p> <p>Next, for clarity, the ISO could use a term other than "New" to distinguish the two conceptual additional transmission projects that will be considered in the out-of-state wind resource assessment. The three "New Tx" projects listed as part of the 2023-2024 TPP are all well advanced projects that will provide "new" transmission capacity to access out of state wind resources. The CAISO could refer to the projects being assessed as "Conceptual Tx" or some other term to provide the appropriate context.</p>	<p>The comment has been noted.</p>

2. Please provide your organizations comments on the approach to offshore wind resources			
No	Submitting Organization	Comment Submitted	CAISO Response
2A	Avangrid Renewables	Avangrid has no comments on this topic at this time	
2B	Avantus Clean Energy LLC	<ol style="list-style-type: none"> 1. Slide #20, has there been any evaluation done whether 7,000 MW of Del Norte Offshore Wind may be too much and may pose reliability risk, to be brought at a single substation whether that substation is constructed offshore or onshore? 2. How many new substations are anticipated to accommodate 20,000 MW of offshore wind and at what locations? 3. Slide #22, regarding an offshore HVDC grid, Avantus suggests avoiding concentration of all 14,600 MW arriving at just one or two substations. 	<p>1. The transmission concepts in the 20-year outlook are based on a high level assessment to provide an insight into transmission needs in the long term. The exact scope of any future project will be determined in detail reliability, policy, and economic studies performed in the Tariff-based annual transmission planning process.</p> <p>The assumption in this 20-year outlook is that all POI substations will be onshore as the offshore floating HVDC converter station technology doesn't exist at this point.</p>
2C	Bay Area Municipal Transmission Group (BAMx)	<p>Anticipated Significant Changes to Offshore Wind (OSW) Resource Selection Requires Revisiting Current TPP Portfolios and CAISO's Determination Regarding Policy-Driven Transmission Upgrades</p> <p>On page 57 of the January 4th presentation, the CAISO states that it would "Coordinate with 2023-2024 TPP Policy Study on selecting the preferred alternative for the OSW interconnection." BAMx appreciates that the CAISO began working on the 20-Year Outlook using the SB 100 starting point scenario before the latest cost information from the California Public Utilities Commission (CPUC) 2023 Integrated Planning Process (IRP) on the OSW, especially in the North Coast area became available. However, BAMx urges the CAISO to have the 20-Year Outlook informed by the latest developments regarding the latest OSW project cancellations cost projections.</p> <p>The recent cancellation of two large OSW projects in New Jersey, whose financial challenges mirror those facing the U.S. OSW market, is still in its infancy.^[1] The same company is also reconsidering two more intended to serve New York and Maryland.^[2] As we know, the East Coast has long been considered a prime location for OSW. Much like the North Sea, its waters are relatively shallow, ideal for turbines. But cancellations to planned projects is occurring after years of development work even under these more favorable conditions. There are considerably more technological, permitting, and environmental challenges to the OSW development in the Pacific than those on the East Coast. As included in the CAISO January 4th presentation, access to OSW is highly dependent on the feasibility of the floating offshore</p>	<p>The objective of coordination between the 20-year outlook and the 2023-2024 TPP is to ensure that the proposed project in the TPP would have the required flexibility to be expanded to the transmission solutions identified in the 20-year outlook.</p> <p>The 20-year transmission outlook analysis focuses on the technical assessment to gain an insight into the system enhancement options required to reliably serve the CEC forecast load and connect the resources in the CPUC portfolio. High level cost estimates will also be provided on required system enhancements that could be taken into account in developing resource portfolios for future 20-year outlook and annual transmission planning processes.</p>

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		<p>turbines on a large scale and other transmission technologies, such as the availability of floating offshore HVDC technology. Such technologies that could be scalable to the resources assumed in the 20-Year Outlook are not commercially available at this time, and their availability in the future is highly uncertain.</p> <p>As stated in the “West Coast Offshore Wind Transmission Literature Review and Gaps Analysis.” prepared by the Pacific Northwest National Laboratory (“PNNL Report,” hereafter)[3], a considerable amount of work needs to be completed before choosing the preferred transmission option(s) for OSW. In particular, the PNNL Report identifies a series of challenges to delivering, transmitting, and producing electricity from OSW plants, especially floating OSW.[4]</p> <ol style="list-style-type: none"> 1. Lack of prioritization for interregional coordination; 2. Limited representation of future supply and demand patterns; 3. Lack of technological readiness of floating transmission and OSW plant infrastructure, and undefined viable subsea cable routes; and 4. No validation of OSW generation attributes, etc. <p>The latest CPUC IRP Ruling on the 2023 Preferred System Plan recommends the 25 MMT Core portfolio as the Base portfolio.¹⁵ If it is adopted by the Commission, then it would be transmitted to the CAISO as both the reliability and policy-driven base case scenario to be analyzed by the CAISO in the 2024-2025 TPP. As summarized in Table 1 below, the Base portfolio in the 2023-2024 TPP included 1,607 MW of OSW resources in the North Coast area, whereas the Sensitivity portfolio in the same TPP cycle assumed as high as 8,045 MW of OSW. The expected costs of OSW are now significantly higher relative to its competing resources across the modeling horizon based on the most recent 2023 National Renewable Energy Laboratory (NREL) Annual Technology Baseline (ATB).¹⁶ As a result, the proposed Base portfolio and the Sensitivity portfolio in the latest Draft Base portfolio select no OSW resources in the North Coast. Also, the proposed Base portfolio in the latest Draft Base portfolio includes only 4,531 MW of OSW, which is entirely mapped in the Morro Bay Call area (Central Coast). In contrast, the proposed Sensitivity scenario does not select a single MW of OSW. The lack of selection of OSW in the proposed 2024-2025 TPP portfolios is driven by significantly higher OSW cost despite the Production Tax Credit (PTC) extension and</p>	<p>The scope of 20-year outlook is a high insight into transmission requirement. A more detailed reliability, policy, and economic studies will be performed with stakeholder input as part of the annual transmission process before any project is proposed for approval.</p> <p>The final portfolio submitted to CAISO for the 2024-2025 TPP includes 1,607 MW offshore wind in the north coast in 2039 as part of base portfolio.</p>

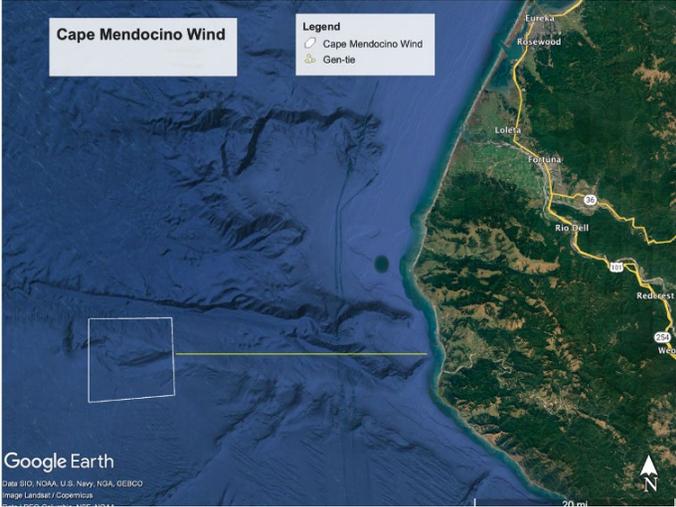
No	Submitting Organization	Comment Submitted	CAISO Response																																														
		<p>lower cost associated with the competing resources given the IRA's PTC extension, such as In-State and OOS wind, solar and geothermal.[7] As evident from Table 1 below, the proposed 2024-2025 TPP portfolios constitute a significant departure from the past portfolios as well as the 20-Year Outlook update that require serious consideration in the CAISO's current, i.e., the 2023-2024 TPP cycle.</p> <p>Table 1: A Comparison of Offshore Wind Resource Capacity (MW) Selected in the 2023-2024 TPP vs. Draft 2024-2025 TPP Portfolios vs. 20-Year Outlook Update</p> <table border="1" style="width: 100%; border-collapse: collapse; margin: 10px 0;"> <thead> <tr> <th rowspan="2">Offshore Wind Area</th> <th colspan="2">2023-2024 TPP*</th> <th colspan="2">Draft 2024-2025 TPP**</th> <th rowspan="2">20-Year Outlook Update***</th> </tr> <tr> <th>Base Portfolio</th> <th>Sensitivity Portfolio</th> <th>Base Portfolio</th> <th>Sensitivity Portfolio</th> </tr> </thead> <tbody> <tr> <td>Morro Bay Call Area</td> <td>3,100</td> <td>5,355</td> <td>4,531</td> <td>0</td> <td>5,400</td> </tr> <tr> <td>Humboldt Call Area</td> <td>1,607</td> <td>2,600</td> <td>0</td> <td>0</td> <td>2,700</td> </tr> <tr> <td>Del Norte Area</td> <td>0</td> <td>3,445</td> <td>0</td> <td>0</td> <td>7,000</td> </tr> <tr> <td>Cape Mendocino Area</td> <td>0</td> <td>2,000</td> <td>0</td> <td>0</td> <td>4,900</td> </tr> <tr> <td>Total North Coast</td> <td>1,607</td> <td>8,045</td> <td>0</td> <td>0</td> <td>14,600</td> </tr> <tr> <td>Total</td> <td>4,707</td> <td>13,400</td> <td>4,531</td> <td>0</td> <td>20,000</td> </tr> </tbody> </table> <p>* https://stakeholdercenter.caiso.com/RecurringStakeholderProcesses/2023-2024-Transmission-planning-process</p> <p>** CPUC ED, "2023 Proposed PSP & 2024-2025 TPP Resolve Modeling Results," October 5, 2023</p> <p>*** CAISO 20-Year Transmission Outlook Update, January 4, 2024, p.20</p> <p>BAMx agrees with the CAISO that they cannot rely on the draft 2024-2025 TPP portfolios until they are finalized and provided to them by the</p>	Offshore Wind Area	2023-2024 TPP*		Draft 2024-2025 TPP**		20-Year Outlook Update***	Base Portfolio	Sensitivity Portfolio	Base Portfolio	Sensitivity Portfolio	Morro Bay Call Area	3,100	5,355	4,531	0	5,400	Humboldt Call Area	1,607	2,600	0	0	2,700	Del Norte Area	0	3,445	0	0	7,000	Cape Mendocino Area	0	2,000	0	0	4,900	Total North Coast	1,607	8,045	0	0	14,600	Total	4,707	13,400	4,531	0	20,000	<p>The 20-year transmission outlook is an informational study and no project will be recommended for approval in the process.</p>
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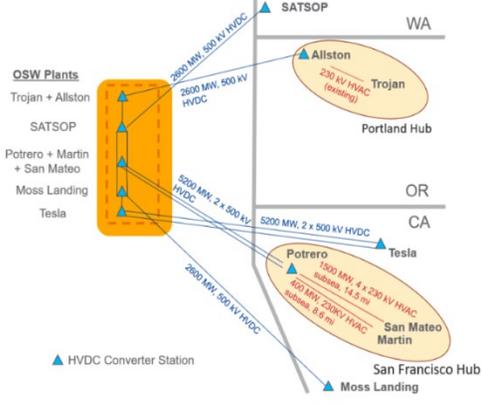
No	Submitting Organization	Comment Submitted	CAISO Response
		<p>CPUC as part of the Final Decision in the IRP proceeding. However, as the CAISO is considering approval of transmission project(s) that are found needed to meet the OSW resource needs of the Base portfolio, it needs to be cognizant of the changed circumstances regarding the economic viability of OSW resources in the North Coast. If the CAISO approves a policy-driven project to accommodate the OSW resources in the North Coast because it aligns with the 20-Year Outlook, that could not only prove to be a sub-optimal outcome but could also lead to stranded asset(s) based on the current expectations regarding the cost of OSW as reflected in the draft 2024-2025 TPP portfolios.</p> <p>As the PNNL report summarizes, "If guided intentionally, offshore wind may provide critical contributions to the bulk electricity transmission system through geographic and technological diversity. However, modifying transmission systems to accommodate these resources incurs long planning processes, uncertain siting requirements and construction timelines, and potentially high costs." There is significant uncertainty and challenges around the development of OSW wind resource development as identified in the PNNL Report, especially on the North Coast. Approving major transmission infrastructure based on speculative resource development may lead to underutilized assets at ratepayers' expense, if not stranded. BAMx urges the CAISO to delay the approval of any policy-driven transmission related to accessing OSW in the North Coast until the CPUC provides clarity based on the above-described updated information.</p> <p>Further Technical Evaluation of OSW Transmission Projects Needs to Be Accompanied By High-Level Permitting/Feasibility/Environmental Assessment</p> <p>Integrating North Coast OSW is a challenging objective with technical, environmental, and scheduling risks. Such risks suggest value in staging transmission improvements in a manner where decisions on higher cost and technically challenging elements are made later in the process once better information is available. The choice between the terrestrial alternatives (Fern Road or Collinsville) will likely depend on environmental factors. It does not appear that these environmental and permitting constraints have been considered in the determination of transmission options yet. Similarly, the CAISO needs to perform high-level technical feasibility and supply chain issues associated with the submarine cable option(s). CAISO's approval of any green-field policy-</p>	<p>The 20-year transmission outlook is an informational study and no project will be recommended for approval in the process.</p> <p>The 20-year transmission outlook is an informational study and no project will be recommended for approval in the process.</p>

No	Submitting Organization	Comment Submitted	CAISO Response
		<p>driven transmission project without considering the feasibility challenges and environmental permitting constraints for transmission development would be counter-productive. Therefore, BAMx recommends that the CAISO conduct a high-level feasibility and environmental permitting assessment before recommending any particular transmission project to access North Coast OSW.</p>	
2D	California Public Utilities Commission - Public Advocates Office	<p>Cal Advocates supports the CAISO's high-level explanation of the interconnection concepts and technological impacts of floating offshore wind (OSW) resources. See Cal Advocates' response to question 3 for our recommendation that CAISO identify investments that could be repurposed if OSW wind resource generation does not come on-line during the proposed timeframe.</p> <p>CAISO should estimate the total generation interconnection costs for OSW and forward this analysis to public agencies and third parties conducting independent studies on the environmental, permitting, and social impacts of OSW in the North Coast and Morro Bay. [1] The recent revised CEC report from Schatz Energy Research Center <i>Northern California and Southern Oregon Offshore Wind Transmission Study Volume 1 (Revised)</i> [2] discusses two different scenarios for OSW interconnection: 1) wind generator-led lines as its primary mechanism to connect OSW to the mainland; and 2) an offshore system operator mechanism.</p> <p>The generator-led lines scheme would require the OSW generator to own and operate those transmission assets to the connection point at the coastal shoreline. In the offshore system operator approach, different wind farms connect to an offshore transmission collector floating substation and the CAISO would integrate the output from multiple wind farms and deliver power into the grid. The 20-Year Outlook should clearly define both scenarios and which entity is responsible for costs related to the developed transmission grid and how the costs would be allocated to the OSW resource developers and Participating Transmission Owners. The impacts to transmission tariff-based rates should also be delineated and projected for each scenario.</p> <p>The OSW generation interconnection scenarios may require enhancements to the current transmission system that vary in cost. Greater detail on the transmission system capital costs from CAISO equips stakeholders with a more complete picture of the total resource costs and ratepayer impacts. For each scenario, CAISO should</p>	<p>The comment has been noted.</p> <p>The comment has been noted.</p> <p>Since the offshore floating HVDC converter station technology does not exist yet, the focus of the analysis in the 20-year outlook is with the assumption that the wind generation is transferred to an onshore POI with AC export cables. A high level concept based on offshore HVDC grid will be discussed without detailed studies or cost estimate.</p> <p>High level cost estimates will be provided in the final report.</p>

No	Submitting Organization	Comment Submitted	CAISO Response
		<p>estimate the transmission costs of upgrades to deliver power to end use customers.</p> <p>In the CEC report <i>Northern California and Southern Oregon Offshore Wind Transmission Study Volume 1 (Revised)</i>, there is a discussion of the permitting challenges for transmission routes. [3] This discussion categorizes permitting barriers as: 1) Low; 2) Medium; 3) High; and 4) Very High. CAISO should include a range of probabilities that each proposed transmission path may be successfully permitted along with a time for completion based on past high voltage permitting challenges in California and Oregon. The CAISO, in its 20-Year Outlook, should provide alternative routing scenarios that account for any inability to overcome defined obstacles listed in the report.</p>	<p>The objective of the 20-year outlook is to provide a high insight into transmission requirement. The 20-year outlook is an informational study and not project will be proposed for approval in the process.</p> <p>A more detailed reliability, policy, and economic studies will be performed with stakeholders input as part of the annual Tariff-based TPP to identify the optimum project to propose for approval.</p>
2E	California Western Grid Development, LLC	<p>California Western Grid asks that CAISO plan transmission to accommodate delivery of at least 8,000 MW of resources at Morrow Bay/ Diablo Canyon in Central California by 2045. The currently proposed 5,400 MW of OSW does not even represent the full resource potential of Central California OSW. In addition, there is significant interest in the Morrow Bay / Diablo Canyon area as a location for battery development as shown in the interconnection request queue. Cal Western agrees the existing 500 KV AC interconnections at Morrow Bay and Diablo Canyon should be fully utilized, however, additional transmission that is able to deliver OSW, battery and Central Valley Solar energy directly to West LA by way of a new subsea HVDC line would: (1) allow for larger build out of OSW resources (2) allow battery storage and central valley solar power to be delivered directly into the transmission constrained LA Basin load pocket and (3) allow for reduced reliance on local area fossil generation in the LA Basin.</p> <p>Many policy objectives could be achieved with a new Subsea HVDC transmission line from Central California to the LA Basin including: (1) SB887 requirement to substantially reduce reliance on gas fired generation in transmission constrained local areas by 2035, (2) reduced reliance on Aliso Canyon gas storage facility, (3) improved air quality for citizens of the LA Basin and local disadvantage communities, (4) reduce wildfire risk, and (5) improve LA Basin local area stability (local frequency and voltage support).</p>	<p>The 20-year outlook study is based on the 2045 portfolio provided by CPUC. Any future 20-year outlook will be based on an updated CPUC portfolio which may include different levels of resources at different location.</p> <p>The comment has been noted.</p>

No	Submitting Organization	Comment Submitted	CAISO Response
2F	Center for Energy Efficiency and Renewable Technology	<p>CEERT notes that there is also significantly more offshore wind development in the 20-Year Transmission Outlook portfolio than in the 2024-2025 TPP base case portfolio. The 2024-2025 proposed TPP base case portfolio shows 2,924 megawatts of Morro Bay offshore wind in 2039 and 1,607 megawatts in the North Coast offshore wind areas. The 20-Year Transmission Outlook portfolio includes 5,400 megawatts at Morro Bay and 14,600 megawatts on the North Coast.</p> <p>CEERT believes that it is worthwhile to model a significant amount of offshore wind emanating from Northern California and Southern Oregon, a region with some of the best wind on the West Coast. However, CEERT believes that the two approaches that have been outlined in the January 4 presentation by the CAISO staff are unrealistic.</p> <p>CEERT believes it will not be possible to develop 4,900 megawatts of wind off the coast of Cape Mendocino and develop transmission to bring this power to California load centers. The Cape Mendocino area, sometimes called the Lost Coast, is one of the most remote areas in California and has very limited terrestrial access. Developing coastal transmission, multiple HVDC converter stations and overhead HVDC lines in this part of California is unrealistic.^[1] The Google Earth image below provides a high level perspective on the challenge of bringing offshore wind to shore at Cape Mendocino.</p>	<p>The comment has been noted.</p> <p>The comment has been noted.</p> <p>Considering the implementation challenges, no onshore AC or HVDC line is considered in the Cape Mendocino area in the 20-year outlook. While export cables from Cape Mendocino to the shore is challenging, the alternative is required offshore floating HVDC converter technology that doesn't exist yet. Both alternatives are being considered in the 20-year outlook to provide a high level insight into both alternatives and their challenges.</p>

No	Submitting Organization	Comment Submitted	CAISO Response
		 <p>CEERT believes that a better approach to transmission planning for Northern California and Southern Oregon offshore wind development has been described in detail in a report issued by Pacific Northwest National Laboratory (PNNL) under contract with the Bureau of Ocean Energy Management [1]</p> <p>The PNNL study modeled three generation and transmission scenarios across two future representations of the Western Interconnection, including (1) 3.4 gigawatts of installed OSW capacity connected through a 2030 high voltage alternating current Radial Topology, (2) 16.3 GW of installed OSW capacity connected through a 2030+ high voltage direct current Radial Topology, and (3) 16.3 GW of installed OSW capacity connected through a 2030+ multi-terminal high voltage direct current Backbone Topology.</p> <p>CEERT encourages the CAISO staff to review this report and include a scenario in the 20-Year Transmission Outlook that includes the HVDC Backbone Topology. The approach used by PNNL assumes the delivery of energy through a networked system to Moss Landing, Potrero, Tesla, Allston and Satsop substations via seven HVDC cables. A schematic of this approach is copied below from the PNNL report</p>	

No	Submitting Organization	Comment Submitted	CAISO Response
		 <p>Figure 14. Transmission expansion incurred by 2030+ MTDC Backbone Topology Graphic not to scale. Cable carrying capacities corresponding to maximum assumed technology limits.</p> <p>In addition to providing reliable access from North Coast offshore wind resources to California and the Pacific Northwest, the Backbone Topology approach improves system resiliency and the amount of deliverable capacity from the wind resources. CEERT understand that there will be issues related to cost allocation if this approach were to be pursued. Nonetheless, it will be valuable to model this approach on the downstream CAISO system.</p>	
2G	Fervo Energy	No comment	
2H	Gallatin Power Partners, LLC	No comment	
2I	Golden State Clean Energy	No comment	
2J	Invenergy	<p>In this update on the 20 Year Transmission Outlook, CAISO has maintained the same approach and planning numbers as the original presentation on August 16, 2023. Invenergy continues to believe that the CAISO should model additional offshore wind in the Central Coast. Generally, the CAISO should include 25 GW of offshore wind, in line with the California Energy Commission (CEC) Assembly Bill (AB) 525 planning goal of 25 GW of offshore wind capacity in California by 2045.[1] The CAISO should also study at least 7,000 MW of offshore wind on the Central Coast specifically.</p> <p>In the response to Invenergy's original comments on the 20 Year Outlook, the CAISO stated that it has pulled these numbers from the portfolios provided by the CEC and California Public Utilities</p>	<p>The 20-year outlook study is based on the 2045 portfolio provided by CPUC. Any future 20-year outlook will be based on an updated CPUC portfolio which may include different levels of resources at different location.</p>

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		<p>Commission (CPUC). However, the methodologies used in the development of the 2045 scenarios does not consider the following:</p> <ul style="list-style-type: none"> • The power density of each existing California lease site will most likely be higher than assumed. • Floating wind turbine technology will undoubtedly evolve over the next several years, and the capacity of each individual turbine will very likely increase. <p>Studies indicate that wind turbine capacity and density figures may be higher than what is assumed in the 2045 Scenarios developed by the CEC and CPUC. The CEC and CPUC have used National Renewable Energy Laboratory (NREL) density factor estimates of 3 MW per km², on the low end, and 5 MW per square kilometer on the high end. [2] Studies have highlighted that existing wind turbines may extract more wind power over less land or water than previously thought.[3] The estimated installed power density of offshore wind turbines indicates a range of 3 to 12 MW/square kilometer (km²) and a mean of 7.36 MW/km². [4] Specifically, the 2021 Energy for Sustainable Development report written by Peter Enevoldsen from the Center for Energy Technologies at Aarhus University and Mark Jacobson from the Department of Civil and Environmental Engineering at Stanford University estimated that the installed power density of offshore wind turbines is 7.2 MW/km². [5] If this mean number were applied to the approximately 975 square kilometers that the Central Coast leases cover, this would equate to over 7,000 MW of offshore wind capacity off the Central Coast based on density figures alone.</p> <p>Finally, as the use of offshore wind energy continues to grow, we expect significant advancements in technology. The average onshore wind turbine from 2011 could produce 1.5 MW of power.[5] In 2019, the average nameplate capacity of newly installed land-based wind turbines in the United States was 2.55 MW, according to Wind Exchange, a United States Department of Energy platform for science and wind energy information.[6] This is a 70% percent increase in per turbine capacity. Given that this is a 20-Year Transmission Outlook, the CAISO should make assumptions about increased capacity from technological advancement for offshore wind turbines.</p> <p>In energy is working with both the CEC and CPUC to incorporate higher power densities into the Integrated Resource Planning (IRP)</p>	

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		<p>and SB 100 planning processes. However, given the long lead-time needed for transmission planning, the CAISO should incorporate these updated figures into the 20 Year Transmission Outlook now.</p> <p>Currently, the CAISO has modeled three scenarios of 5,400 MW being allocated between the Diablo substation and a potential new Morro Bay substation: 1) 5,400 MW mapped to the Diablo substation, 2) 5,400 MW mapped to the new Morro Bay substation, 3) 2,400 MW mapped to the new Morro Bay substation and 3,000 MW mapped to Diablo. The CAISO should also consider upgrading capacity in the area beyond 5,400 MW, adding an additional 1,600 MW to the analysis, to accommodate additional offshore wind resources up to 7,000 MW. At a minimum, considering a total of 7,000 MW in a sensitivity case will allow stakeholders to evaluate the costs of additional upgrades in the Central Coast area to enable additional offshore wind in the existing lease areas.</p>	
2K	LSA	LSA has no comments at this time.	
2L	RWE Renewables	<p>RWE appreciates the opportunity to provide inputs to CAISO's 20-year transmission outlook on the approach to offshore wind. We would like to provide some feedback on the North Coast Offshore wind interconnection concepts.</p> <ol style="list-style-type: none"> 1. Interconnection approach, offshore grid doesn't have to be HVDC (Slide 22) <ul style="list-style-type: none"> • We would like to point out that depending on the availability of floating offshore substation technology, either HVAC and HVDC export cables may be used to connect the offshore wind plant to an onshore POI substation. • For the offshore POI approach, the offshore grid doesn't necessarily need to use HVDC technology. If HVAC grid can effectively transfer power between each lease area, it should not be precluded as an option especially considering the higher capital cost and additional R&D investment required for the floating HVDC grid solution. 2. Export cable can be either dynamic or static (Slide 24) 	<p>The export cable technology (AC or HVDC) does not have an impact on the overall transmission plan for interconnection to the CAISO grid as it will only change how the power is transferred to an onshore POI. The main potential impact of the floating offshore HVDC converter station and dynamic HVDC cable technologies, in addition to export cables, is that it will facilitate the offshore interconnection of 3 wind areas and to deliver power directly to the substation in Bay area. Given the distance, offshore interconnection of different wind areas with AC cables is not practical. The transmission concepts for offshore wind integration will be updated depending on the rating and timing of the floating offshore HVDC converter station and dynamic HVDC cables.</p>

No	Submitting Organization	Comment Submitted	CAISO Response
		<ul style="list-style-type: none"> • The offshore substation may implement either a "floating" or "subsea" solution. Both technologies require further research and development to become qualified for use. If a "floating" solution (AC or DC) is selected, dynamic HV export cables will be required. If a "subsea" solution is selected, static HV export cables will be sufficient. • The commercial availability of dynamic AC cables varies depending on site metocean conditions and system voltage levels. While dynamic array cable (66kV and less) designs have been developed, their suitability for specific dynamic application depends entirely on the environment within which they are installed. • We agree that higher voltage (greater than 66kV) dynamic cables at the power ratings required for offshore wind (100s of MW) are under development. <p>3. The necessity of floating offshore HVDC grid (Slide 25)</p> <ul style="list-style-type: none"> • We agree that an offshore HVDC grid can offer benefits to the reliability of offshore generation systems. These benefits can be realized by the wind farm developer(s) and electricity customers. However, if the lease area is close to shore, the implementation of an HVDC transmission technology may not be necessary from a technical perspective. Having an offshore grid requirement and necessitating that the offshore grid use HVDC needs to be cautiously evaluated. Aside from the additional capital expenses incurred during research & development and in procurement, an offshore grid poses challenges for operations and maintenance, contractual obscurity (metering, damages, etc.), engineering, etc. that should be considered and quantified. 	<p>The comment has been noted.</p>
2M	TransWestExpress LLC	Transwest does not have comments on this portion of the meeting.	

3. Please provide your organizations comments on the high level technical assessment scenarios, mapping of resources, load forecast and dispatch

No	Submitting Organization	Comment Submitted	CAISO Response
3A	Avangrid Renewables	Avangrid reiterates its main points outlined in response to Question 1. CAISO should consider permitting implications in addition to cost when mapping interconnection points for new transmission to import additional out of state wind resources. It may be more feasible and expedient from a permitting perspective to interconnect new transmission for importing out of state wind at the CAISO border and upgrade the existing CAISO transmission system than it would be to interconnect this new transmission at interconnection points closer to load centers within the CAISO system. For all out of state wind resource mapping, CAISO should take stakeholder feedback on out of state permitting considerations and transmission availability when determining which interconnection points for out of state wind resources are optimal.	The comment has been noted.
3B	Avantus Clean Energy LLC	<ol style="list-style-type: none"> Slide #35, CAISO HSN load in 2045 is shown as 64,923 MW (~65,000 MW). Yet, the installed generation capacity in the same year shown on slide #12 is 164,993 (~165,000 MW). Can you clarify why the installed capacity in 2045 is more than 250% of the CAISO load? Does this discrepancy between load and installed capacity cause serious technical problems in creating power flow base cases? The load growth in the 10-year period from 2035 to 2045 is 13% - 14%, meaning ~1.4% per year. The installed capacity in the same 10-year period grows at ~9% per year (slide #12). Can you explain why installed capacity is not closely following the load growth? 	From the ~165,000 MW resources in the CPUC portfolio, ~58,000 MW are storage resources that do not “generate” power but rather they will store the generated energy from other resources such as solar and wind to deliver it to the grid at a later time such as early evening that solar generation is reduced to zero. Considering 15,000 MW gas retirement assumption in the portfolio, the actual resource addition in the 2045 CPUC portfolio is ~92,000 MW with majority of them being intermittent solar and wind generation. Those resources are required to not only serve the forecast load but also charge the storage units.
3C	Bay Area Municipal Transmission Group (BAMx)	<p>More Information is Needed to Better Understand the Key Drivers</p> <p>CAISO has not provided detailed information regarding the generation levels, such as which gas-fired generators were assumed to be offline in each of the four scenarios. Without such details, it is quite tricky, if not impossible, to interpret the findings meaningfully. BAMx requests the CAISO to provide the details on the gas-fired retirements, just like the Dashboard the CAISO has provided that shows renewable resource mapping.</p>	The ISO will include the generation retirement list based upon the criteria provided by the CPUC and CEC with the 20-Year Transmission Outlook.
3D	California Public Utilities Commission - Public Advocates Office	<ol style="list-style-type: none"> CAISO should incorporate updates to the base case portfolio in CAISO's 2024-2025 Transmission Plan (TPP) 	

No	Submitting Organization	Comment Submitted	CAISO Response
		<p style="text-align: center;">with the 2045 Scenario assumptions in CAISO's 2024 20-Year Transmission Outlook.</p> <p>Cal Advocates recognizes the constraints of the CAISO to continually refine the high-level assessment in the 20-Year Outlook so that generation dispatch assumptions are matched with resource portfolios developed in the Integrated Resource Planning (IRP) process. However, the inputs and assumptions used in the IRP proceeding to model an optimal resource generation mix by 2045 provide the basis for the tariff-based transmission upgrades that are ultimately approved in the TPP. The CAISO should coordinate the resources assumed in the 2045 Scenario of the 20-Year Outlook with the proposed IRP resource portfolio being transmitted to CAISO for the 2024-2025 TPP.</p> <p>B. CAISO should analyze and discuss the performance of transmission projects in multiple alternative generation scenarios by 2045.</p> <p>Resources assumed in the 20-Year Outlook that bear discrepancy or misalignment with the IRP process should be treated with extra scrutiny and calculation by CAISO. Cal Advocates particularly suggests that resources needing extra consideration are North Coast OSW, Morro Bay OSW, New Mexico out of state wind, and North Nevada geothermal. For example, the 2045 capacity expansion modeling results from the current IRP Proposed Decision include 4.5 gigawatts (GW) of offshore wind.^[1] The updated 20-Year Outlook instead assesses a 2045 portfolio with 20 GW of offshore wind.^[2] Transmission projects that are intended to integrate uncertain resources^[3] could cause adverse bulk transmission system impacts and incur unnecessary costs for ratepayers.</p> <p>CAISO should classify transmission projects as least-regret investments based on their versatility and flexibility across alternative resource generation scenarios. CAISO should independently study the transmission upgrades required for uncertain resources under alternative generation scenarios.^[4] Cal Advocates recommends CAISO include a section in the 20-Year Outlook that discusses resource portfolios in alternative scenarios that supplement or substitute the current portfolio using the proposed set of transmission</p>	<p>The 20-year outlook is an informational study and is based on the 2045 portfolio provided by CPUC. Any future 20-year outlook will be based on an updated CPUC portfolio which may include different levels of resources at different locations.</p> <p>The objective of the 20-year outlook informational study is to gain an insight into the transmission enhancement required for the 2045 CPUC portfolio. No transmission projects will be recommended for approval in the 20-year outlook process.</p> <p>The projects that will be proposed for approval for the integration of the offshore wind in the Tariff-based Transmission Planning Process will take into account many factors such as cost and flexibility for variety of future scenarios.</p>

No	Submitting Organization	Comment Submitted	CAISO Response												
		<p>upgrades. CAISO should determine how the identified transmission projects perform under the alternative generation scenarios.</p> <p>CAISO's use of these measures supports the identification of transmission projects that could be repurposed or still address a need if the CEC's load forecast used in the 20-Year Outlook is not accurate or the proposed generation does not come online when anticipated. Cal Advocates encourages CAISO to consider the risks of long-term planning so that the impacts to ratepayers are transparent without hindering the preparation needed to address major changes to the energy system by 2045.</p>	<p>The comment has been noted.</p>												
3E	California Western Grid Development, LLC	<p>CAISO should focus on transmission needed to deliver renewable resources into Transmission Constrained Load Areas. The analysis presented on January 4 focused on delivering resources from renewable energy areas to the high voltage 500 KV and 230 KV grid. That is only half the story; resources must also be deliverable to transmission constrained load centers.</p> <p>It is difficult to develop a meaningful transmission road map when resource portfolios developed in CPUC IRP proceedings vary wildly from year to year in terms of renewable technologies and resource locations.</p> <p>Here are some specific examples from the 20-year outlook resource assumptions for 2045 the CAISO presented in the January 4, 2024 update compared to the CPUC IRP High Gas Retirement Sensitivity portfolio for the 2024-25 TPP for the year 2045:</p> <table border="1" data-bbox="514 1112 1199 1360"> <thead> <tr> <th></th> <th>CAISO 20-Year Transmission Outlook Update (1-4-24)</th> <th>CPUC IRP High Gas Retire Sensitivity (1-10-24)</th> </tr> </thead> <tbody> <tr> <td>Offshore Wind -2045</td> <td>20.0 GW</td> <td>0.0 GW</td> </tr> <tr> <td>Long duration storage -2045</td> <td>9.0 GW</td> <td>3.7 GW</td> </tr> <tr> <td>Battery Storage - 2045</td> <td>48.8 GW</td> <td>32.9 GW</td> </tr> </tbody> </table> <p>While the CPUC resource portfolios swing dramatically from year to year, the loads are not going anywhere. State policy [SB100, SB887] clearly requires that dependence on gas fired generation in local areas</p>		CAISO 20-Year Transmission Outlook Update (1-4-24)	CPUC IRP High Gas Retire Sensitivity (1-10-24)	Offshore Wind -2045	20.0 GW	0.0 GW	Long duration storage -2045	9.0 GW	3.7 GW	Battery Storage - 2045	48.8 GW	32.9 GW	<p>The objective of the high level assessment in the 20-year outlook is to gain an insight into the required bulk transmission system enhancements. Detailed analysis to determine the optimum solution including the impact of load forecast in local areas are performed in future TPP cycles.</p> <p>Any future 20-year outlook assessment will be based on an updated CPUC portfolio which may include different levels of resources at different locations.</p>
	CAISO 20-Year Transmission Outlook Update (1-4-24)	CPUC IRP High Gas Retire Sensitivity (1-10-24)													
Offshore Wind -2045	20.0 GW	0.0 GW													
Long duration storage -2045	9.0 GW	3.7 GW													
Battery Storage - 2045	48.8 GW	32.9 GW													

No	Submitting Organization	Comment Submitted	CAISO Response
		<p>must come to an end, and in transmission constrained local areas such as West LA, batteries can only provide part of the solution.</p> <p>The Update to the 20-Year Transmission Outlook must focus on robust transmission solutions for local areas that are transmission constrained. It should cast a wide net and prioritize transmission solutions that meet the resource needs of transmission constrained local areas from a wide range of resources, technologies, and locations. This is especially important given how unstable CPUC Resource portfolios are from year to year.</p> <p>The PTEP HVDC subsea transmission project from Central California to the LA Basin is a perfect example of the kind of robust transmission solution that can deliver renewable energy to the LA Basin from Central California offshore wind, storage and solar from the Central Valley. A project that can support delivery from a wide range of resource types and locations.</p> <p>The PTEP HVDC project also injects needed local stability (voltage and frequency support) as well as black start capability to West LA when existing local gas generation is unavailable or is eventually retired in future CPUC resource portfolios.</p> <p>By focusing on least regrets transmission into local areas that are constrained, the CAISO can avoid a situation where, because of portfolios with shifting resource types and locations, transmission needs identified in a future TPP were not anticipated in the 20-Year Outlook.</p>	
3F	Center for Energy Efficiency and Renewable Technology	<p>CEERT is also concerned with the busbar mapping for the ~15,000 megawatts of gas generation that are assumed to be modeled as offline in 2045. At the January 4 meeting the CAISO indicated that it plans to use the busbar mapping from the 2021 Starting Point Scenario for the locations of the ~15,000 megawatts of gas power plant capacity that would be modeled as offline. CEERT believes that using this older busbar mapping would be a mistake that would likely result in a less useful analysis of long term transmission needs.</p> <p>Environmental justice organizations and others have been working with the CPUC to develop criteria for selecting gas resources that will be modeled as off in TPP portfolios. As a result the CPUC has developed criteria that incorporates locational, emissions-related and performance</p>	

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		<p>data. At their December 8, 2023 workshop the CPUC staff described the factors that will be used to identify gas resources that should be modeled as offline. They include: 1) proximity to an area identified as a Disadvantaged Community, 2) NOx emissions multiplied by capacity factor, 3) location in EPA's ozone and PM 2.5 non-attainment zones and 4) plant age. These criteria are being used in busbar mapping for the 2024-2025 TPP sensitivity portfolio</p> <p>The busbar mapping of the locations of gas plants to be modeled as offline in the CPUC December 8, 2023 workshop is significantly different from the busbar mapping used in the 2021 Starting Point Scenario that the CAISO is considering using. [1] Table 2 below compares the locations by local capacity areas.</p> <p style="text-align: center;">Table 2 – Comparison of Busbar Mapping for Gas Generation</p> <table border="1" data-bbox="512 805 1199 1386"> <thead> <tr> <th>Area</th> <th>20-Year Outlook (2045)</th> <th>24-25 High Gas Retirement (2039)</th> <th>Prorated High Gas Retirement (2045)</th> </tr> </thead> <tbody> <tr> <td>Total</td> <td>14,408</td> <td>10,469</td> <td>14,408</td> </tr> <tr> <td>Bay Area</td> <td>4,427</td> <td>1,260</td> <td>1,734</td> </tr> <tr> <td>BC/Ventura</td> <td>695</td> <td>349</td> <td>480</td> </tr> <tr> <td>Fresno</td> <td>669</td> <td>648</td> <td>892</td> </tr> <tr> <td>Kern</td> <td>407</td> <td>304</td> <td>418</td> </tr> <tr> <td>LA Basin</td> <td>3,632</td> <td>3,104</td> <td>4,272</td> </tr> <tr> <td>Not in LCR</td> <td>3,933</td> <td>3,622</td> <td>4,985</td> </tr> <tr> <td>SD-IV</td> <td>131</td> <td>625</td> <td>860</td> </tr> <tr> <td>Sierra</td> <td>153</td> <td>196</td> <td>270</td> </tr> <tr> <td>Stockton</td> <td>361</td> <td>361</td> <td>497</td> </tr> </tbody> </table> <p>CEERT believes that the mapping of the locations of gas resources to be modeled as offline in the 20-Year Transmission Outlook is very important and should be addressed. One possibility would be to model two different gas retirement scenarios.</p>	Area	20-Year Outlook (2045)	24-25 High Gas Retirement (2039)	Prorated High Gas Retirement (2045)	Total	14,408	10,469	14,408	Bay Area	4,427	1,260	1,734	BC/Ventura	695	349	480	Fresno	669	648	892	Kern	407	304	418	LA Basin	3,632	3,104	4,272	Not in LCR	3,933	3,622	4,985	SD-IV	131	625	860	Sierra	153	196	270	Stockton	361	361	497	<p>The 20-year outlook study is based on the 2045 portfolio provided by CPUC. Any future 20-year outlook will be based on an updated CPUC portfolio which may include different levels of resources at different location. In addition the 20-year transmission outlook portfolios are reasonably aligned with the sensitivity portfolio in the CPUC decision for the 2024-2025 transmission planning process.</p>
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3G	Fervo Energy	No comment	
3H	Gallatin Power Partners, LLC	No comment	
3I	Golden State Clean Energy	<p><u>High BESS/low import/low wind scenario</u></p> <p>Golden State Clean Energy (“GSCE”) supports the high BESS/low import/low wind scenario, including the focus on storage charging needs under this scenario and the identification of new or upgraded transmission to support storage charging. This scenario will help the state develop a plan to account for two large contingencies in the current portfolio: the future availability of West-wide resources outside of California and the development timeline for certain wind projects.</p> <p>The high BESS/low import/low wind scenario is not only needed to understand possible system reliability and transmission needs in 2045, but it can also provide helpful information about California’s transition from its current resource fleet to the portfolio of resources envisioned in this study. GSCE encourages CAISO to consider how the 20-Year Transmission Outlook can be used to better inform the transmission projects that will be approved at various mid-points during the next 20 years, looking not only at the ultimate transmission needs by 2045 but also understanding any benefits of certain transmission facilities interacting together that may justify right-sizing or approval of a group of transmission projects.</p> <p>There is significant uncertainty about when certain resources in this portfolio can be brought in-service (e.g., offshore wind, out-of-state resources requiring new transmission). Although GSCE supports planning for these more uncertain resources and an all-of-the-above resource strategy, there are other resources in the portfolio like in-state solar and storage that use known technologies and can be developed in the next decade or so. The fact that resources like in-state solar and storage are needed long-term but also have more certain near-term development timelines means the related transmission for these resources are no regrets. Transmission necessary to achieve a large-scale solar buildout is necessary in the long-term to meet state greenhouse gas emissions goals. Building these resources earlier, considering also the storage that now frequently accompanies solar, provides assurance that the state can meet reliability and RPS requirements in the near-term and mitigates the risk of project failure or delays associated newer technologies. The state planning entities can benefit from better understanding the full scope of these no regrets</p>	<p>The comment has been noted.</p> <p>The comment has been noted.</p> <p>While the high level assessment in the 20-year outlook informational study provides an insight into the transmission needs in the long term, the portfolios in the 10 and 15 year tariff-based TPP capture will be used for the detail reliability, policy, and economic studies which will be the basis for proposing a project for approval. Such projects will be selected and proposed in TPP taking into account future uncertainty in load forecast and resource portfolio assumptions.</p>

No	Submitting Organization	Comment Submitted	CAISO Response
		<p>transmission projects as the IRP and TPP are making decisions about resources needed in the early and mid 2030s. GSCE believes California needs to prioritize no regrets transmission solutions that can allow new resources to be brought in-service in the early and mid 2030s.</p> <p><u>Alternative solution</u></p> <p>GSCE supports the potential for a Manning-Moss Landing 500 kV line as highlighted on slides 46 and 47. Transmission solutions like this are needed to allow Southern PG&E solar to scale to its potential and serve load in the Greater Bay Area and enable the retirement of existing gas generation. Increasing transmission capacity from Southern PG&E solar resources to the Greater Bay Area can also provide energy for storage resources in the Greater Bay Area that will be critical for providing Local RA.</p> <p>GSCE seeks to better understand the pros and cons of varying transmission configurations for increasing the transfer capability between San Joaquin Valley solar and storage resources and the Greater Bay Area. CAISO should also study new 500 kV transmission lines heading north from the San Joaquin Valley to Tesla/Tracy/Metcalf as a means of serving the Greater Bay Area and northern California with San Joaquin Valley solar and storage. This would be in addition to the current assessment of the Manning-Moss Landing 500 kV line to provide a comparative analysis of multiple transmission futures, akin to the analysis of offshore wind. Studying alternative transmission configurations for northern California can help stakeholders better understand the following:</p> <ul style="list-style-type: none"> • Whether there is planning synergy with San Joaquin Valley solar and Northern California offshore wind or whether they may contribute to congestion in similar areas based on certain transmission configurations. • How transmission coming out of the San Joaquin Valley to the west versus the north differs under the high BESS/low import/low wind scenario and other scenarios. <p>It may also be that the system benefits from multiple new 500 kV transmission lines out of the valley that reach both Moss Landing and substations to the north. This could especially be true if, in addition to</p>	<p>The comment has been noted.</p> <p>The comment has been noted.</p> <p>The comment has been noted.</p>

No	Submitting Organization	Comment Submitted	CAISO Response															
		<p>resources already being studied in the area, CAISO studies a full solar and storage build at the hypothetical Westlands Substation identified in the original 20-Year Transmission Outlook or other substations that may be needed in Southern PG&E to integrate solar in this area, as the approval of a new substation would likely impact on the busbar mapping underlying this study and would allow San Joaquin Valley solar to scale up even further.</p> <p>Lastly, in our December 4, 2023, comment on the 2023-2024 TPP's preliminary policy and economic results, [1] GSCE proposed CAISO study the Monarch 500 kV Transmission Project. We recommend CAISO also study this project as one way to deliver San Joaquin Valley solar and storage to the Greater Bay Area or as a way to address long-term Path 15 congestion.</p>	<p>The comment has been noted.</p>															
3J	Invenergy	No comment																
3K	LSA	<p>LSA is concerned that the 2045 Resource Portfolio developed by the CEC/CPUC for the 20-Year Outlook may not allocate sufficient resources to certain zones, which could ultimately impact where CAISO builds transmission in the upcoming TPP cycles. In some cases, the amount of MWs allocated to specific areas in 2045 for the 20-Year Outlook is less than the amount allocated to the same area in 2039 for the proposed 2024-25 TPP. For example:</p> <table border="1" data-bbox="611 951 1213 1224"> <thead> <tr> <th data-bbox="611 951 898 1084">RESOLVE Resource Name</th> <th data-bbox="898 951 1066 1084">20-Year Outlook 2045 (MW) [1]</th> <th data-bbox="1066 951 1213 1084">2024-25 TPP 2039 (MW) [2]</th> </tr> </thead> <tbody> <tr> <td data-bbox="611 1084 898 1122">Greater Kramer Solar</td> <td data-bbox="898 1084 1066 1122">3460</td> <td data-bbox="1066 1084 1213 1122">4438</td> </tr> <tr> <td data-bbox="611 1122 898 1159">Southern NV Eldorado Solar</td> <td data-bbox="898 1122 1066 1159">6326</td> <td data-bbox="1066 1122 1213 1159">7701</td> </tr> <tr> <td data-bbox="611 1159 898 1196">Northern CA Wind</td> <td data-bbox="898 1159 1066 1196">339</td> <td data-bbox="1066 1159 1213 1196">2258</td> </tr> <tr> <td data-bbox="611 1196 898 1224">Baja Wind</td> <td data-bbox="898 1196 1066 1224">600</td> <td data-bbox="1066 1196 1213 1224">2472</td> </tr> </tbody> </table> <p>This discrepancy means that CAISO may be planning for more transmission in certain areas to meet the needs of its 2024-25 TPP than what it may include in the 20-Year Outlook. This could complicate and/or delay CAISO's decisions about whether to approve upgrades in the 2024-25 TPP when the 20-Year Outlook may not identify the need for the same upgrades. Even though the 20-Year Outlook is informational only, LSA encourages CAISO to address the potential discrepancies to avoid unnecessary procedural delays. CAISO, the CEC and the CPUC should acknowledge, potentially via a joint agency</p>	RESOLVE Resource Name	20-Year Outlook 2045 (MW) [1]	2024-25 TPP 2039 (MW) [2]	Greater Kramer Solar	3460	4438	Southern NV Eldorado Solar	6326	7701	Northern CA Wind	339	2258	Baja Wind	600	2472	<p>CAISO is required to propose projects for approval if the CPUC base portfolio results in a transmission need in annual tariff-based transmission planning process. The results of the sensitivity portfolio and the 20-year outlook will serve as additional input to the planning process to assess how flexible the base portfolio transmission solution should be to facilitate future expansion.</p>
RESOLVE Resource Name	20-Year Outlook 2045 (MW) [1]	2024-25 TPP 2039 (MW) [2]																
Greater Kramer Solar	3460	4438																
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No	Submitting Organization	Comment Submitted	CAISO Response
		<p>letter, that as resource and transmission development begins to occur at a faster pace, it may be difficult for the 20-Year Outlook to keep pace with TPP developments. The CAISO's TPP process should not be impacted by mistakenly low or out-of-date resource estimates provided for the 20-Year Outlook process when it has more accurate, updated data to rely upon in its TPP process. Alternatively, CAISO could update the 20-Year Outlook portfolio based on the CPUC's 2023-24 TPP portfolio, which should be adopted in February 2024.</p>	
3L	RWE Renewables	No comment	
3M	TransWestExpress LLC	TransWest does not have comments on this portion of the meeting.	

4. Please provide your organizations comments on the preliminary results of the HSN scenarios.

No	Submitting Organization	Comment Submitted	CAISO Response
4A	Avangrid Renewables	Avangrid has no comments on this topic at this time	
4B	Avantus Clean Energy LLC	<ol style="list-style-type: none"> Some of the RAS are well established and are applied in CAISO TPP studies and generation interconnection studies. Why is RAS not considered in this study? Was Hydro generation and pumped-hydro generation modeled near peak output in the HSN case? The results do not show overloads on the lower voltage systems such as 138 kV, 115 kV and 70 kV. Are these circuits not monitored in the study? If these are monitored, then can you please explain why these lower voltage systems are not found overloaded? 	<ol style="list-style-type: none"> The impact of RASes were taken into account in the post-processing of the results. If any overload identified in the study could be addressed by an existing RAS, no mitigation will be proposed for that overload. The assumption is consistent with the 2035 summer peak case The objective of the 20-year outlook is the bulk power system at 230 kV and 500 kV. Lower voltage issues are considered local that could better be addressed in the annual transmission planning process.
4C	Bay Area Municipal Transmission Group (BAMx)	<p>Detailed Assumptions and Results Should be Provided Well in Advance to Interpret the Preliminary Results Meaningfully</p> <p>BAMx appreciates the preliminary results of the HSN scenarios provided by the CAISO during the meeting on January 4. However, the summary results included in the January 4th presentation do not give a complete picture. For instance, which N-1 contingency under the High OSW scenario causes a potential overload on the Embarcadero - Potrero 230 kV line is unclear.^[1] Also, these summary results do not provide much insight into how those findings align with the HSN scenario results for the Sensitivity Case in the 2023-2024 TPP.^[2] For instance, the summary results do not show any overload on the <i>Collinsville – Pittsburg 230 kV line Constraint</i> leading to the need for <i>Collinsville 230 kV Reactor</i> or <i>North Dublin - Vineyard 230 kV Constraint</i> triggering reconductoring. BAMx requests that the CAISO posts detailed assumptions and results in advance of the final 20-Year Outlook report so that stakeholders have adequate time and opportunity to review them before providing comments.</p>	<p>The projects that are proposed for approval in the 2023-2024 TPP are modelled in the 20-year outlook base cases</p>
4D	California Public Utilities Commission - Public Advocates Office	<p>Cal Advocates recommends that CAISO consider a cost savings analysis of the proposed mitigations measures in High System Need (HSN) scenarios in the 20-Year Outlook update. Where mitigation measures address N-0 and N-1 conditions or N-1-1 conditions that cannot be addressed through generation redispatch after the first contingency, CAISO should evaluate the relative cost savings of alternative solutions such as grid-enhancing technologies (GETs) and joint funding partnerships.</p>	<p>The overall approach in the 20-year outlook high level assessment is that if generation redispatch would address any identified overload, no other mitigation measure will be recommended. Detailed reliability, policy, and economic studies performed in future TPP cycle will determine the optimum solution considering grid enhancing technologies.</p>

No	Submitting Organization	Comment Submitted	CAISO Response
		<p>GETs like dynamic line ratings and smart wires enable low-cost interconnections of newly added resources and maximize the value of transmission enhancements. The Federal Energy Regulatory Commission (FERC) also recommends that transmission providers consider whether adding dynamic line ratings or advanced power flow control devices to existing transmission facilities could meet the same transmission need more efficiently or cost-effectively than a new transmission facility.[1]</p> <p>Joint funding partnerships could increase the diversity of resources delivered to the grid at a reduced cost to ratepayers (i.e., expensive resources such as OSW become more economical through cost-sharing benefits). Partnerships should be explored for transmission projects identified to support delivery of North Coast OSW resources on the grid and in tariff-based projects that will supply OOS wind to the CAISO footprint. In addition, Cal Advocates supports that CAISO develop a cost benefit analysis of alternative solutions using radial and backbone typologies when looking at the integration of PNW interties and extensions with the 2045 Scenario portfolio.[2]</p> <p>As California aims to reach its long-term energy goals, CAISO's long-term view of transmission planning should balance trade-offs between adding more resources in strategic locations where there is transmission capacity available or investing in new transmission development to access resources not yet intertied to the CAISO bulk power system. In a system-wide cost savings analysis broken down by the CAISO study area, the CAISO should identify where new resource generation dispatch on existing transmission infrastructure provides greater savings than adding currently undeliverable resources through new transmission investment. The analysis helps inform a transmission capacity expansion investment strategy that, when transmitted to the IRP process, optimally converges with the least-cost resource portfolio. Only after all economical mitigations have been exhausted, Cal Advocates supports consideration of new wire solutions.</p>	<p>The comment has been noted.</p> <p>The comment has been noted.</p>
4E	California Western Grid Development, LLC	Cal Western has no comment on the thermal study results presented by CAISO on January 4, 2024, however Cal Western strongly endorses the need for CAISO to update its local area battery analysis. Based on comments during the January 4 Stakeholder meeting, we understand that CAISO has not yet evaluated transmission needs to local areas	The 20-year outlook focuses on the bulk power system at 230 kV and above. Future TPP and local capacity requirement (LCR) studies will determine the local area system enhancement requirements based on the resource portfolio of such studies.

No	Submitting Organization	Comment Submitted	CAISO Response
		<p>that will likely emerge as transmission constraints render battery solutions infeasible due to charging limits.</p> <p>We look forward to the results of that analysis and ask the CAISO to report in detail on situations where batteries in transmission constrained local areas depend on local gas plants for charging.</p> <p>In cases where batteries meet local reliability requirements by relying on gas generation for charging, those battery solutions should be rejected and replaced by transmission solutions to allow clean system preferred resources meet local reliability needs.</p>	
4F	Center for Energy Efficiency and Renewable Technology	<p>CEERT is not commenting on the preliminary results of the HSN scenarios. However, we agree with the scenario approach that will test stressed grid conditions when there is low output from out-of-state and offshore wind resources.</p> <p>CEERT recommends that the CAISO staff rerun the modeling of the four HSN scenarios based on the changed assumptions noted in the comments above.</p>	The comment has been noted.
4G	Fervo Energy	No comment	
4H	Gallatin Power Partners, LLC	<p>Gallatin Power appreciates the CAISO's presentation of the preliminary results of the HSN scenarios. As detailed in our comments to item 1 above, Gallatin Power supports CAISO's approach to studying interconnection of out-of-state wind in the Lugo area to further enhance the CAISO system by creating an additional point of interconnection for out-of-state resources instead of continuing to compound the existing Southern Nevada – LA Basin CAISO connection bottleneck</p> <p>Gallatin Power supports CAISO's Next Steps, specifically testing alternative interconnection points for out-of-state wind.</p>	The comment has been noted.
4I	Golden State Clean Energy	No comment	
4J	Invenergy	No comment	
4K	LSA	LSA has no comments at this time	
4L	RWE Renewables	No comment	
4M	TransWestExpress LLC	TransWest does not have comments on this portion of the meeting	

5. Please provide any additional comments your organization has on the 20-Year Transmission Outlook update.

No	Submitting Organization	Comment Submitted	CAISO Response
5A	Avangrid Renewables	Avangrid has no further comments at this time	
5B	Avantus Clean Energy LLC	<p>1. Slide #11, comparing Base Portfolio (Base) and OSW Sensitivity (OSW), why is Geothermal reduced from 2037 MW in the Base to 1149 MW in the OSW? Isn't Geothermal considered as a baseload power plant and should not be reduced?</p> <p>2. Slide #13, retired capacity of 3,933 MW is designated as "ISO system". Which pockets in the ISO system do these gas-fired generation belong to?</p> <p>3. Slide #14, how many total new substations have been proposed in this 20-year Outlook? Have those substations been assigned future resources?</p>	<p>The 20-year outlook study will be based on the 2045 portfolio. The other portfolios on slide 11 are provided for comparison purposes.</p> <p>Resources that are required from resource adequacy standpoint but are not part of any local area, are considered "ISO System" resource.</p> <p><i>The Final 2045 Scenario Mapping Dashboard at https://www.energy.ca.gov/publications/2023/2045-scenario-update-20-year-transmission-outlook provides the list of substations for resource mapping</i></p>
5C	Bay Area Municipal Transmission Group (BAMx)	As mentioned earlier, providing the underlying assumptions and detailed technical assessment results at the same time or after the final 20-Year Outlook report is issued will not provide the stakeholders any opportunity to provide meaningful comments. Therefore, BAMx requests the CAISO to provide this information as soon as possible.	The comment has been noted.
5D	California Public Utilities Commission - Public Advocates Office	<p>Cal Advocates requests that CAISO provide revised cost estimates for transmission upgrades required to integrate the resources in the 2045 Scenario. The 20-Year Outlook published in May 2022 estimated \$30.5 billion in transmission development costs.[1] The installed capacity in the updated 20-Year Outlook 2045 Scenario increases by 44,612 megawatts (MW) from the 2040 portfolio published in May 2022.[2] Newly installed resources would likely result in additional required upgrades to the existing CAISO footprint and Humboldt Bay OSW area as identified by CAISO in the high-level assessment. Cost estimates should account for the transmission development needed to address the resources added to the 2023-2024 20-Year Outlook. In addition to refreshed transmission cost estimates under the updated 2045 Scenario, CAISO should explain what the main drivers of the transmission cost estimate changes are and where in the bulk transmission system they occur.</p> <p>Cal Advocates recommends the CAISO expand the scope of the 20-Year Outlook to include the impact of the revised cost estimate on the CAISO Transmission Access Charge (TAC) that ratepayers within the CAISO's balancing authority would bear. Additionally, Cal Advocates recommends CAISO clarify whether the new cost estimates of</p>	<p>The 20-year outlook report will include revised cost estimates</p> <p>All the approved projects in previous transmission plans and also all the proposed projects in the 2023-2024 TPP are considered as the starting point for the 20-year outlook.</p>

No	Submitting Organization	Comment Submitted	CAISO Response
		<p>interconnection and mitigation measures includes all the incremental development costs approved (but not yet included in TAC rates) in the CAISO's current and previous TPP cycles. Adding this information will help provide perspective to forecasted TAC rate increases going forward.</p> <p>While the 20-Year Outlook is described as informational, it does affect the direction of procurement and transmission policies.[3] The purpose of the 20-Year Outlook is not meant for near-term resource procurement decisions and should remain an informative tool for the "longer-term context for and framing of issues in the 10-Year Transmission Plan." [4] Cal Advocates recognizes and supports the long-term view of transmission needed to reliably meet California's clean energy goals and ambitious climate change goals.</p>	<p>The comment has been noted.</p>
5E	California Western Grid Development, LLC	<p style="text-align: center;">CAISO 20-Year Transmission Outlook Update 1/4/24 Stakeholder Meeting</p> <p style="text-align: center;">Cal Western Comments</p> <p>California Western Grid Development LLC, ("Cal Western") appreciates this opportunity to comment on the January 4, 2024, CAISO 20-Year Transmission Outlook Update.</p> <p>Cal Western strongly endorses the 20-year transmission outlook update. A conceptual roadmap showing how the grid could be expanded to support California's decarbonized future is critical to good planning.</p> <p>Prioritize Transmission Solutions for Transmission Constrained Local Areas.</p> <p>Cal Western requests the CAISO 20-year transmission outlook update fill an additional void in the California resource and transmission planning process: to evaluate if the CPUC strategy of building more and more system wide renewable energy resources to achieve decarbonization is seriously flawed. Flawed because CPUC models are unable to detect transmission constraints that will force gas plants to be dispatched out of merit order to maintain local reliability.</p> <p>The CPUC is requesting CAISO provide this leadership and identify transmission needs for transmission constrained local areas. As stated</p>	<p>The comment has been noted.</p>

No	Submitting Organization	Comment Submitted	CAISO Response
		<p>in the recent 1/10/24 CPUC IRP Ruling transmitting Portfolios for the 2024-25 TPP:</p> <p><i>“Conducting locational analysis within the context of IRP is difficult, because much of our [CPUC] analysis historically has been focused at the system level. The CAISO, however, has the ability to do much more granular and detailed analysis of local reliability needs. Therefore, we find it prudent to ask the CAISO to conduct this sensitivity analysis for the 2024-2025 TPP.” [1]</i></p> <p>The CAISO lead role in identifying transmission needs for local areas should not be limited to the 2024-25 TPP. CAISO leadership on transmission solutions for constrained local areas is an essential part of the CAISO 20-Year Transmission Outlook Update, the 2023-24 TPP and all future TPPs.</p> <p>The CPUC planning tools RESOLVE and SERVM simply do not have the zonal granularity to determine if the CPUC stated strategy of building ever more system wide renewable resources will work to reduce dependence on fossil generation in major load centers such as the LA Basin and SF Bay area.</p> <p>This CPUC strategy is stated at page 74 of the January 10, 2024, CPUC IRP ruling. The CPUC is planning ever more renewable resources in an effort to push gas fired resources further up the resource dispatch stack and thereby run at ever decreasing capacity factors. A strategy that is flying blind to transmission constraints that prohibit renewable energy from flowing to major load centers such as the LA Basin. As a result, gas plants in transmission constrained load pockets are likely to operate at ever-increasing capacity factors as local loads grow and perhaps to charge local utility scale batteries—unless and until more transmission is built.</p> <p>CAISO has the tools and resources to provide the leadership that will allow California to realize the SB100 goals, meet the requirements of SB887, and allow citizens including disadvantaged communities in major load centers such as the LA Basin to benefit from cleaner air.</p> <p>Additional transmission to relieve constraints into local areas is also needed to allow <u>system</u> resources to compete with <u>local</u> resources in</p>	<p>Detailed analysis of local area needs are best suited for the annual transmission planning process and the local area requirement studies. The objective of the 20-year outlook is to provide an insight into bulk transmission system needs based on a high level assessment.</p>

No	Submitting Organization	Comment Submitted	CAISO Response
		<p>meeting the energy needs of transmission constrained load pockets. New transmission that can enable system resources to compete with local resources will head off the potential dire economic consequences of monopsony pricing by a few fossil generators that are available resources to meet load requirements in local load pockets.</p> <p>The California Department of Water Resources recently contracted for resources needed to create the AB 205 California Strategic Reserve is a good example of the extraordinary prices that a fossil generator located in the transmission constrained local area could demand for Local RA procured through the CPUC IRP proceeding or procured through the CAISO emergency procurement provisions.</p> <p>The Dept of Water Resource, the agency responsible for securing California's strategic reserve resources paid the incredibly high price of nearly \$1.2 billion for 2,200 MW of gas plants to be in emergency standby for three years.^[2]</p> <p>This extraordinary cost was surely driven by a number of factors, including the limited supply of uncontracted-for resources with the characteristics necessary to participate in the Strategic Reserve, in other words a lack of competition.</p> <p>Now let's consider the LA Basin in the 2030's. Without new transmission, West LA alone will need 3,000 to 5,000 MW of local gas plants for local RA.^[3] The existing plants eligible to supply West LA Basin RA will be 40, 50 and 60+ years old. They were not designed to run that long. Some will fall by the wayside due to mechanical failure, some will be shuttered by ever demanding environmental regulations. The remaining few available plants will be the only game in town available to keep the lights on. One can easily imagine the CPUC regulated LSEs paying more than the cost of new transmission for just a few years of West LA RA service from the remaining local gas plants.</p> <p>There is an additional reason the CAISO should address transmission needs of location constrained load pockets in the 20-Year Transmission Outlook Update and in the current TPP.</p>	

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		<p>Resource portfolios developed in CPUC IRP proceedings vary wildly from year to year in terms of renewable technologies and resource locations.</p> <p>Here are some specific examples from the 20-year outlook resource assumptions for 2045 the CAISO presented in the January 4, 2024 update compared to the CPUC IRP High Gas Retirement Sensitivity portfolio for the 2024-25 TPP for the year 2045:</p> <table border="1" data-bbox="514 521 1199 769"> <thead> <tr> <th></th> <th>CAISO 20-Year Transmission Outlook Update (1-4-24)</th> <th>CPUC IRP High Gas Retire Sensitivity (1-10-24)</th> </tr> </thead> <tbody> <tr> <td>Offshore Wind -2045</td> <td>20.0 GW</td> <td>0.0 GW</td> </tr> <tr> <td>Long duration storage -2045</td> <td>9.0 GW</td> <td>3.7 GW</td> </tr> <tr> <td>Battery Storage - 2045</td> <td>48.8 GW</td> <td>32.9 GW</td> </tr> </tbody> </table> <p>While the CPUC resource portfolios swing dramatically from year to year, the loads are not going anywhere. State policy [SB100, SB887] clearly requires that dependence on gas fired generation in local areas must come to an end, and in transmission constrained local areas such as West LA, batteries can only provide part of the solution.</p> <p>The Update to the 20-Year Transmission Outlook must focus on robust transmission solutions for local areas that are transmission constrained. It should cast a wide net and prioritize transmission solutions that meet the resource needs of transmission constrained local areas from a wide range of resources, technologies, and locations. This is especially important given how unstable CPUC Resource portfolios are from year to year.</p> <p>The PTEP HVDC subsea transmission project from Central California to the LA Basin is a perfect example of the kind of robust transmission solution that can deliver renewable energy to the LA Basin from Central California offshore wind, storage and solar from the Central Valley. A project that can support delivery from a wide range of resource types and locations.</p>		CAISO 20-Year Transmission Outlook Update (1-4-24)	CPUC IRP High Gas Retire Sensitivity (1-10-24)	Offshore Wind -2045	20.0 GW	0.0 GW	Long duration storage -2045	9.0 GW	3.7 GW	Battery Storage - 2045	48.8 GW	32.9 GW	
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		<p>The PTEP HVDC project also injects needed local stability (voltage and frequency support) as well as black start capability to West LA when existing local gas generation is unavailable or is eventually retired in future CPUC resource portfolios.</p> <p>By focusing on least regrets transmission into local areas that are constrained, the CAISO can avoid a situation where, because of portfolios with shifting resource types and locations, transmission needs identified in a future TPP were not anticipated in the 20-Year Outlook.</p> <p>20-Year Outlook Update Local Area Battery Analysis.</p> <p>Cal Western strongly endorses the need for CAISO to update its local area battery analysis. Based on comments during the January 4, 2024, Stakeholder meeting, we understand that CAISO has not yet evaluated transmission needs to local areas that will likely emerge as transmission constraints render battery solutions infeasible due to charging limits.</p> <p>We look forward to the results of that analysis and ask the CAISO to report in detail on situations where batteries in transmission constrained local areas depend on local gas plants for charging.</p> <p>In cases where batteries meet local reliability requirements by relying on gas generation for charging, those battery solutions should be rejected and replaced by transmission solutions to allow clean system preferred resources meet local reliability needs.</p> <p>SB 887 requires a substantial reduction in reliance on fossil generation in transmission constrained local areas by 2035. Increasing the use of local area fossil resources to charge local batteries flies in the face of this legislative mandate, which had 100% approval in both the Senate and the Assembly.</p> <p>Given the Senate Bill 887 focus on reducing reliance on gas-fired resources by 2035, and the 10 year or more lead time for new transmission, this issue must be addressed in the 20-Year Transmission Outlook, and now, starting with the 23-24 TPP.</p>	

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5F	Center for Energy Efficiency and Renewable Technology	CEERT appreciates the CAISO's leadership in initiating the 20-Year Transmission Outlook planning process. We found the first 20-Year Transmission Outlook report to be very informative and helpful in shaping longer term resource planning. We understand the tremendous amount of work that is involved in conducting the necessary power flow and reliability modeling. Nonetheless, we believe that the assumptions used for the modeling need to be revised.	The comment has been noted.
5G	Fervo Energy	<p>I. Introduction:</p> <p>Fervo Energy Company ("Fervo") appreciates this opportunity to provide comments on the California Independent System Operator's ("CAISO") vision and the significant efforts it took to complete the 20-Year Transmission Outlook. This forward-looking analysis will assist in shaping an energy transition that achieves SB100, ensures reliability, and builds resilience.</p> <p>II. About Fervo Energy:</p> <p>Fervo is a developer of utility-scale enhanced geothermal systems (EGS) projects with lease holdings across the West, including California. Fervo is actively developing projects to support the California grid, including the 400-megawatt Cape Station project in Beaver County, Utah. Cape Station will deliver its first phase of carbon-free electricity to the California grid in 2026 to support power purchase agreements (PPAs) with several California Load Service Entities (LSEs).</p> <p>In part due to California's leadership on reliability and grid decarbonization, next-generation geothermal technologies are set to play a critical role in achieving a reliable and affordable carbon-free grid. Fervo is excited to work with the CAISO to integrate these new clean firm technologies and resources into the state's resource planning to ensure a smooth and cost-effective pathway to a fully decarbonized grid.</p> <p>III. California's modeling of geothermal resources fails to capture the impact of innovations in EGS and understates the potential for geothermal imports, particularly from the Southwest and Intermountain West states.</p>	

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		<p>Next-generation geothermal technology has experienced recent breakthroughs and is poised to experience rapid growth. By 2028, Fervo's 400MW Cape Station project, located in Beaver County, Utah, will deliver high-capacity factor, weather-independent, carbon-free generation into CAISO. Cape Station is a first-of-a-kind project, which demonstrates that projects of its scale are feasible across the West. Recent research from Princeton University researchers found that using today's technology EGS capacity in the West could expand to 30 GW, and up to 120 GW with further advances in drilling costs.^[1] The 20-Year Outlook, however, does not account for this expansion over time and does not fully consider the potential growth of geothermal generation, especially imports, that will be coming from this geothermal revolution.</p> <p>The 20-Year Outlook provides a detailed look at the transmission needed to accommodate several nascent technologies, like offshore wind, that will eventually be beneficial for increasing reliability. Geothermal deserves a similar analysis. Unlike other emerging clean firm resources, EGS is on track to deliver electricity before 2030 and can scale easily with modular project designs and a robust domestic supply chain. The CAISO should anticipate the growth of geothermal in its 20-Year Outlook similar to the way it plans for the substantial transmission buildout required to accommodate offshore wind.</p> <p>The current resource portfolio contained in the CAISO 20-Year Outlook reflects outdated assumptions of geothermal imports. Specifically, the current modeling portfolio includes geothermal resources in the Salton Sea region but neglects the potential of much larger and lower-cost resources out of state. Firm and dispatchable geothermal imports stand to play an important role in maintaining reliability in California, similar to the role that out-of-state hydropower has played historically. Already, California LSE's are procuring out-of-state geothermal at a faster rate than in-state resources. The CAISO should consider transmission that enables delivery of geothermal imports in support of systemwide reliability benefits.</p> <p>IV. California must improve its modeling and planning around reliability imports and should follow the resource portfolio identified in the CPUC's High Gas Retirement Sensitivity analysis.</p>	<p>The 20-year outlook is based on the 2045 resource portfolio. Any potential future 20-year outlook will use the most up to date resource portfolio.</p> <p>Any potential future 20-year outlook will use the most up to date resource portfolio.</p> <p>The comment has been noted.</p> <p>The comment has been noted.</p>

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		<p>As the CAISO works to update the 20-Year Outlook in parallel with the ISO's 2023-2024 transmission planning process, special attention be paid to the High Gas Retirement Sensitivity portfolio identified in the Proposed Decision Adopting 2023 Preferred System Plan in Rulemaking 20-05-003. The High Gas Retirement Sensitivity portfolio provides a more reasonable view of the growth of geothermal and the need for imports from the Southwest. Regardless of gas retirements in the LA Basin, this sensitivity most accurately reflects the availability of geothermal imports.</p> <p style="text-align: center;">V. Conclusion</p> <p>Thank you for providing the opportunity to provide feedback on the CAISO 20-Year Transmission Outlook Update Meeting. We look forward to further engagement in refining the resource planning process and providing feedback on the CAISO's strategies to achieve greenhouse gas reduction and other state policy goals.</p>	<p>The comment has been noted.</p>
5H	Gallatin Power Partners, LLC	No comment	
5I	Golden State Clean Energy	<p>The 20-Year Transmission Outlook provides important insight into the CAISO arid's long-term transmission needs, but the CPUC IRP process does not currently provide a way for its model to consider the upgrades that the 20-Year Transmission Outlook identifies. For instance, the new "Westland 500/230 kV Substation" in the original 20-Year Transmission Outlook could be a very important new transmission facility for solar development in the region, but it is not included in CAISO's 2023 transmission capability estimates white paper and thus not modeled as a candidate for RESOLVE. Enabling the IRP to formally consider upgrades that the 20-Year Transmission Outlook identifies will provide more meaningful linkage between the 20-Year Transmission Outlook and the IRP-TPP process where resource decisions are made. CAISO should include in its 20-Year Transmission Outlook studies any analysis needed so that major new high voltage facilities that are important to renewable zones like the San Joaquin Valley can be formally considered in the IRP (i.e., added to CAISO's white paper). Otherwise, this important region will struggle to scale development to the degree envisioned in the 20-Year Transmission Outlook.</p>	<p>The comment has been noted.</p>
5J	Invenergy	No comment	
5K	LSA	LSA has no comments at this time	
5L	RWE Renewables	No comment	
5M	TransWestExpress LLC	TransWest does not have comments on this portion of the meeting	

